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Design, Construction and Operation of Municipal Works

1928 — W. P. Gillette Editor — Vol. LXXV. No. 1

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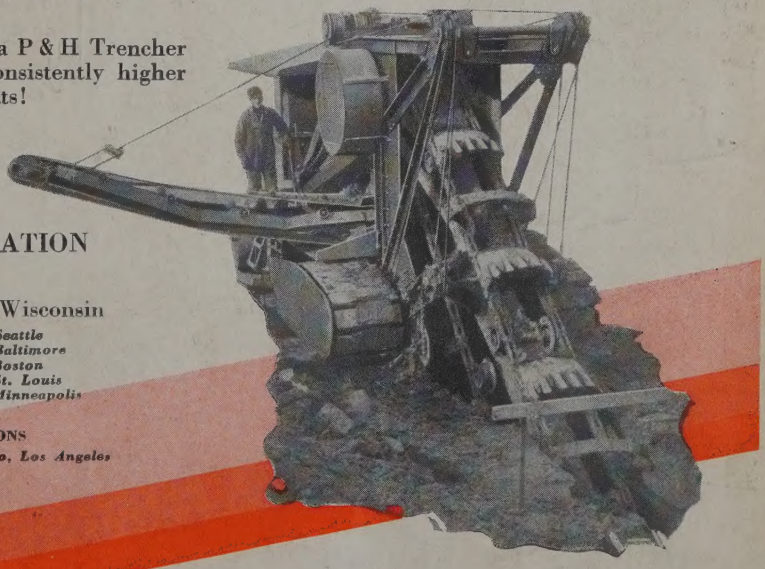

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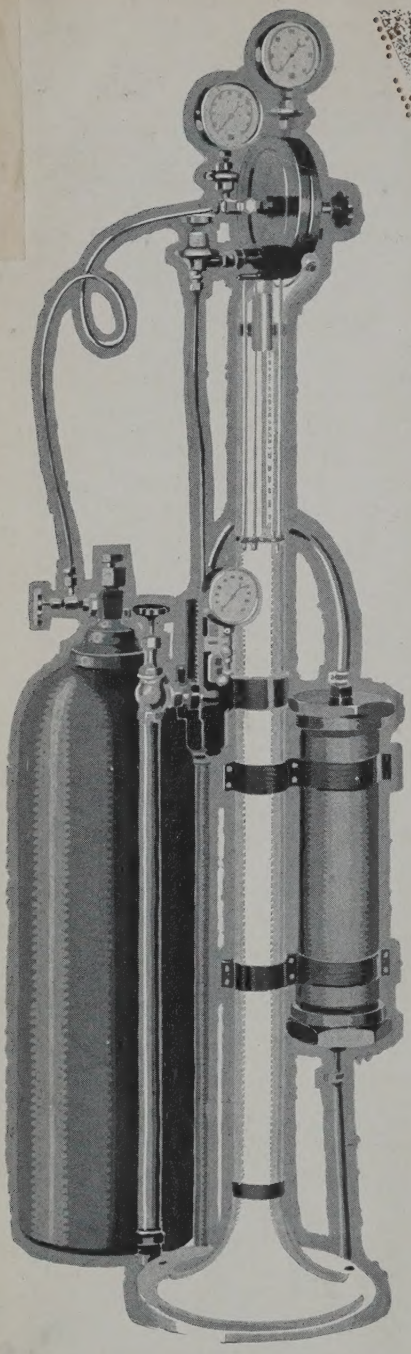

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The Merger of "Municipal News" and "Water Works"

With this issue the oldest municipal magazine merges with the oldest water works magazine in America. "Municipal News" was founded in 1890 as "Municipal Engineering." "Water Works" was founded eleven years ago as an hydraulic monthly issue of the weekly magazine, "Engineering and Contracting." Later "Water Works" was entirely separated from the parent magazine.

"Municipal News and Water Works," the new name of the merged magazines, starts its career with a net paid circulation that exceeds 11,700. The gross circulation is 16,000.

This magazine will be edited by Halbert P. Gillette, chief editor; C. T. Murray, managing editor, and Charles Carroll Brown, associate editor. Mr. Brown was for many years the editor of "Municipal Engineering," and his old readers will be glad to hear that he has taken up his editorial pen again.

The editorial policy will be to publish both technical and non-technical articles relating to the design, construction, maintenance and operation of city "works." We use the term "works" to designate what private companies usually call "plant," sewers, waterworks, pavements, traffic signals, swimming pools, playgrounds, schools, street lights—all the structures, machines and devices that comprise the "plant" with which a modern municipality serves the public, constitute the municipal "works" with which this magazine deals.

There is but one other American municipal magazine of national circulation that attempts to cover this broad field. A comparison of the articles in our issues with those in any issue of our contemporary will show that there is very little duplication either as to the particular subjects or as to their editorial treatment. In fact it is impracticable for a single monthly magazine to cover this field completely.

There are five large and thriving monthly architectural magazines of national circulation, not to mention several others edited primarily for builders rather than for architects. There are four large civil engineering and contracting magazines of national circulation, besides several devoted to various branches of that field. Such facts make it clear that at least two large national magazines are needed to serve the municipal field.

"Municipal News" has been owned by the Gillette Publishing Co. for 12 months. A careful study of its paid circulation and that of "Water Works" has shown the publishers that three-fourths of the subscribers of the one are either actual or potential subscribers of the other. This springs from the fact that the average city engineer, city official, and city superintendent has several functions to perform, and therefore needs more than a narrowly specialized magazine.

Of the 10,000 American municipalities only a few hundred are large enough to warrant the employment of different men to perform each of the different functions involved in designing, building and maintaining the city "works."

With this brief outline of our editorial and publishing policies we greet our old readers of both magazines, and submit the first issue of the enlarged magazine.

Some Suggestions for Electric Signals at Crossings

An insurance adjuster recently told the editor that 85 per cent of the motor car accidents that he handles are collisions at highway crossings. Where automatic signals have been placed at crossings, accidents are rare. Does this not point the way very clearly to one of the means by which such accidents may be almost eliminated? Shall we not ultimately come to electric "stop and go signals" at almost every street intersection? Shall we not find the same protection desirable at all road crossings where any obstruction prevents a clear view of vehicles approaching along both roads? The expense of any such general system of signalling will be enormous, but we believe it may be found to be justifiable. At any rate, the steadily mounting record of casualties calls for something more effective than fines or even imprisonments.

If highway crossings need electric signals, certainly railway crossings need such signals even more. Here the state should share the expense with the railway. In addition to signals at railway crossings it may become desirable to install some sort of device that will act

somewhat as do the "telltales" in front of a railway tunnel. These "telltales" are merely short pieces of rope suspended from a wire across the track, a short distance from the tunnel. A careless brakeman walking on top of a freight car feels the impact of the "telltales," and hastens to crouch. In like manner, a wire-cage drum might span a road, and the "telltales" might be wound around the drum. On the approach of a train, the drum would be tripped, and the "telltales" would drop so as to form a sort of rope curtain across the road, which no automobilist would be likely to pass. The "telltales" would be wound up automatically as soon as the train had passed.

Laws that attempt to govern the speed of automobiles have not accomplished the result, primarily because it is impracticable to patrol the highways with enough policemen. But this does not necessarily mean that we must forever depend upon the common sense and integrity of car drivers to drive at safe speeds. It would be feasible to install automatic drop "telltales" along highways at intervals, which would so operate that any car exceeding the prescribed limit would find its windshield repeatedly battered by the suspended ropes. Already "stop and go signals" are operated in many cities by "the progressive system," in such a manner that a car may proceed in one direction at a prescribed speed without interruption. A lower or higher speed causes interruption of the car's progress. Thus the speed of the traffic is controlled automatically. Some such control may ultimately be adopted even for country roads. But while signal lights serve well in a city where policemen are at hand to enforce respect for them, something else may be needed on country roads, such, for example, as the suggested drop "telltales."

The problem of traffic control in cities has already been largely solved by automatic signalling, supplemented by the "traffic cop." It remains only to perfect some of its details, and to make it practically universal. The problem of traffic control on country roads is more difficult, and has scarcely yet been given serious engineering study.

The Distinction Between City Progress and City Wastefulness

The rising cost of city government is a frequent cause of criticism. Yet criticism merely because such costs have risen is no more justifiable that diatribes against the high cost of living. There are some writers who think they have damned a city administration when they have shown that its annual budget has doubled in the last 15 years. They conveniently overlook the fact that, due to the inflation of our currency, wages and salaries have more than doubled. They often forget to mention that the city has grown 30 or more per cent in population. And they rarely consider the fact that per capita production in America is fully one-third more than it was 15 years ago.

When people produce more they must of necessity consume more, else their increased productivity is senseless. If they choose to employ a large part of their increased productive power in the building of better streets, better hydraulic works and more commodious public buildings and schools, they are not the extravagant fools that their critics would have us believe.

While the nature of municipal construction and maintenance has not changed greatly during the past decade, its volume has increased greatly and seems likely to go on increasing in geometrical ratio. Perhaps the newest branch of municipal construction relates to traffic control by signalling apparatus, if we except the building of aviation fields. The motor car has created the one; the airplane is creating the other.

Municipally owned golf-links, tennis courts, bowling greens, swimming pools, and other municipally owned "entertainment plants," as they may be called, are becoming rapidly more numerous. An age of diffused wealth is ushering in an age of entertainment and sports. Man's "work from sun to sun" began to vanish about a century ago. The 44-hour week is now quite common, and the 40-hour week is in the offing. All this has come because brains and freedom to use the results of brain work have quintupled the annual output of the average American worker during the past century.

When we read protests about municipal extravagance, we may be quite sure that they come from men who have not studied the statistics of American productivity. Our great-great grandfathers had all the necessities of life, for they lived. We who have five-fold their real income must spend at least four-fifths of it for "luxuries"; and we do. Yet many of these so-called "luxuries" actually create more knowledge, by the aid of which our productivity is increased.

The motor car was at first a luxury affordable only by the rich. It is now not only the every day tool of millions, but its development has affected numberless economies. Our transportation costs have been greatly reduced by the motor car. As against the Chinese coolie still pushing his ancient one-wheel barrow, or the Japanese jinrikisha man trundling his two-wheel buggy, contrast our motor trucks and automobiles. No Chinese editors are urging taxpayers to vote against the "extravagance" of paving streets, or building schools. Poor devils, they have no money to be extravagant with. Necessity has squeezed their income lemon so dry that no juice for "extravagance" remains.

In a celebrated French treatise on "The Theory of Probabilities," its author, M. A. Quetelet, says: "It has been justly remarked that those are the most civilized countries that pay proportionately the most to the government." Of course there are exceptions to this generalization, as when a socialistic government or a government burdened by a huge war debt extracts from its citizens much more than 10 per cent of their gross income. But it is certainly true that as a rule, only wealthy peoples devote a considerable part of their income to the building, operation and maintenance of public works. And, with rare exceptions, the more intelligent peoples are the wealthier. Peculiar indeed would be our intelligence were we to attempt to hold down our municipal expenditures to the level of 15 years ago, when our real income per capita has increased fully one-third.

H. P. Gillette

Water Sampling Devices for the Water Works Operator

Aids in Controlling the Purification Processes

By J. D. EDAL BEHRAM
Shanghai Water Works Co., Ltd., Shanghai, China

IN a water plant convenient water sampling devices are a great help in controlling the purification processes.

Figure 1 shows a sampling stick (any convenient length) of the pull-push type capable of carrying two bottles one 250 c. c. and the other 500 c. c. size. The sampling stick is immersed to any desired depth (judged by a scale marked on the stick for the purpose) in the water, the brass rod pulled (which withdraws the stopper) and pushed down as soon as the bottle is full. This device is very convenient for open water volumes and shallow depths.

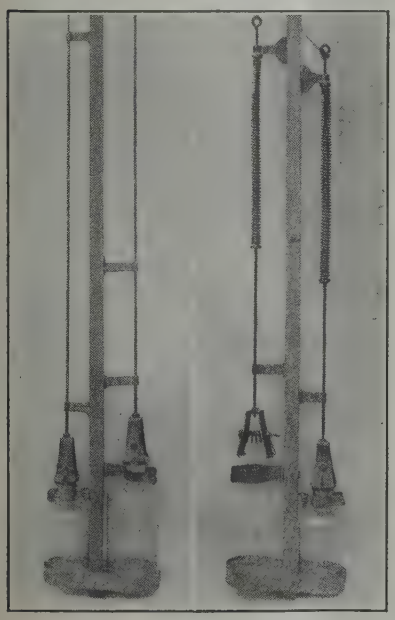


Fig. 1

Fig. 2

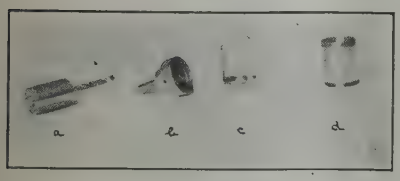


Fig. 3

Figure 2 shows another device for sampling filter wells, reservoirs and the like. Here the brass rods are eliminated and a string used instead for withdrawing and replacing stoppers. The string is just pulled and let go when the bottle is full the spring on the top of the clamp putting the stopper in place. The stick can be made as long as desired by joining together convenient wooden lengths by means of bolts and adding the corresponding length of string.

Figure 3 shows the component parts of an average sampler. When an average sample is desired from several places, say several filter beds, the sampler is sterilized in the usual way and attached to the mouth of a sterilized bottle with a sterile rubber cork (see Fig. 4). The sampling arrangement is immersed in the volume of water to be sampled, the string is pulled and after a few seconds let go. This injects into the bottle a measured quantity of water each time that the bottle is introduced into a new source and the string pulled and released.

With a 10 c. c. capacity sampler as many as 20 samples can be conveniently taken with an ordinary 250 c. c. bottle without any risk of contamination. This obviates the necessity of sterilizing large quantities of bottles, pipettes, etc., when testing the efficiency of several groups of filter beds and comparing the filtering efficiency of individual filter groups of say 5-20 beds in a purification plant. Where the plant is very large and filtering units, clear water wells, etc., numerous this sampler should prove of great use.

Figure 3 (a) shows the plunger with a guide rod and spring, and a strip bent at right angles to the plunger. (b) is the base with nozzle cap. A straight hole through the base connects the barrel (d) with the interior of the bottle. Two holes, one bored on the side and another bored half way up through the base (see Fig. 5) to meet at right angles to the one bored on the side, form an elbow passage for

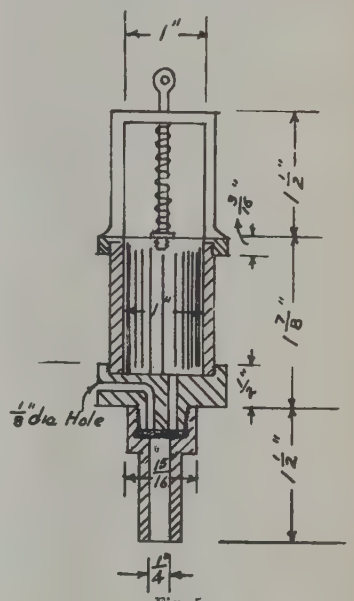


Fig. 5

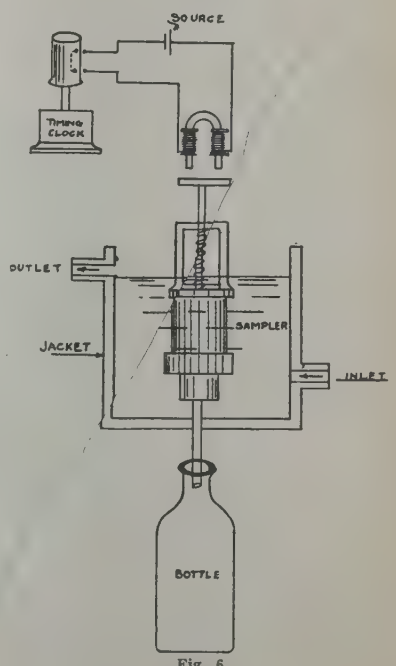


Fig. 6

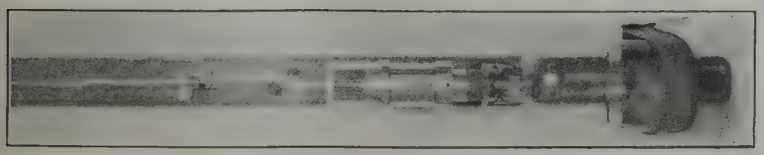


Fig. 4

the in going water and out coming air. (c) serves as a cap with stirrup guide. The spring strip bent over at right angles and attached to the plunger runs parallel to the barrel and meets the orifice of the water inlet and air release passage (just described) in the base. This strip is indented at its lowest point to form on its inner face a small projection which snugly fits into the orifice at the base. This arrangement acts as a combined air release and stop valve.

When samples are to be taken continuously and at regular intervals so as to obtain a good daily average sample, the arrangement shown in Fig. 6 should prove useful. In water plants drawing water from tidal rivers a good average daily sample for the purpose of determining the optical turbidity, suspended matter, chlorine, alkalinity, etc., is an absolute necessity. Samples taken at random or without proper intervals are not much good. The timing clock actuates an electromagnet (which admits water into the sampler at proper intervals and injects it into the bottle) by a revolving make-and-break contact piece making say one revolution per hour if an hourly sample is desired. The water to be sampled continuously runs in and out to waste from the encircling jacket which may be connected to the pump.

Gaining Additional Capacity in Standpipe

Inadequate Structure Rebuilt As Water Tank

By S. S. GEAR
Contracting Engineer, Horton Steel Works, Bridgeburg, Ont.

IN order to increase the volume of water available in overhead storage, the Township of Stamford, surrounding the City of Niagara Falls, Ontario, is undertaking an unusual job of rebuilding an existing standpipe. This township is one of the richest in that portion of Ontario, most of the transmission lines of the power companies passing through the territory. The population is greatly scattered, thus necessitating long water services for supplying residences in the outlying districts from the heart of the business center.

The existing standpipe, grown unable to satisfy the requirements of the water system, was one built some time ago. This standpipe was 14 ft. 4 in. in diameter and had a height of 100 ft., therefore possessing a volume of approximately 126,000 gal. (U. S.). The demand for water in the summer months had become so great that the supply finally proved inadequate, and in fact the homes in the vicinity of the standpipe could not obtain water on the second floors, as a maximum head of water could not be maintained in the standpipe, and the head actually available was not usually sufficient to deliver the required pressures at the second floor fixtures in these homes.

In order to maintain the original maximum head theoretically supplied by this standpipe, a greater storage volume had to be made available.

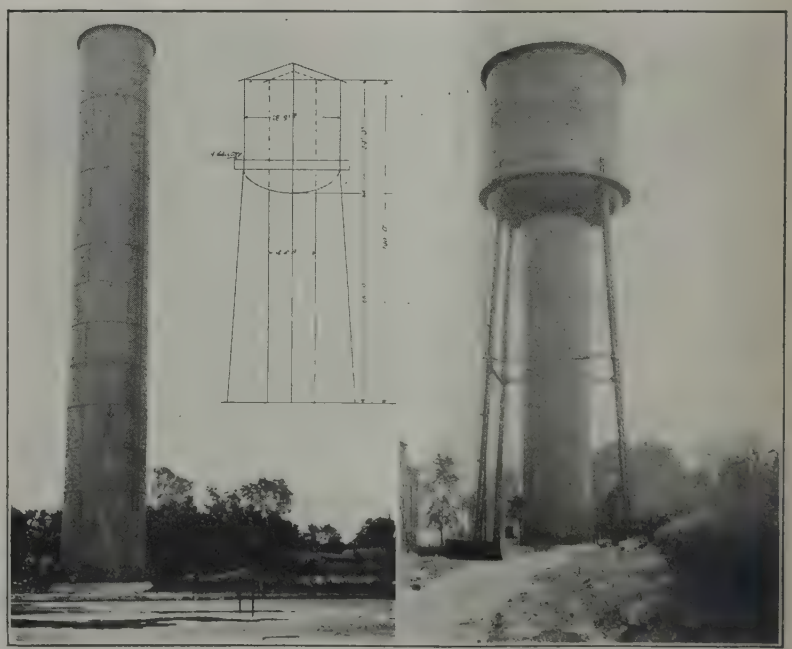
To do this it was decided to remove 34 ft. from the top of this existing standpipe and replace this removed section with a 28 ft. 8 in. diameter elliptical bottom conical roof tank, the top of which, after connection would be made with the remaining portion of the standpipe, would be 100 ft. above the top of the foundations. The elliptical bottom of this tank would, under this plan, be framed into the original standpipe at the top of the remaining portion, approximately 66 ft. above the foundations.

The work was done in this manner, as shown in the drawing, with the dotted lines showing the original standpipe and the heavy lines showing the completed work.

In constructing the work in this way, the remaining portion of the old standpipe serves as a riser pipe to the elevated elliptical bottom tank, and the bottom of this 14 ft. section also acts as a good sediment basin since the inlet pipe in the bottom extends some 8 or 10 ft. up into the standpipe.

This construction, of course, does not increase the available head, since the top remains at 100 ft. above the foundations as before, but the increased diameter affords a volume of 156,000 gal. (U. S.) stored in this tank the bottom of which is 66 ft. above the foundations. This affords a more ample supply for peak demands and thus will more nearly maintain the desired maximum head than was possible before. The result is better service to the consumer.

This work was done by the Horton Steel Works, Ltd., of Bridgeburg, Ont., a subsidiary of the Chicago Bridge and Iron Works, Chicago, Ill., from a design prepared by the writer.



This Drawing Shows the Existing Standpipe, Dotted Lines, and the Modified Structure, as Built. Using the Lower Two-Thirds of the Existing Standpipe in the New Structure Views Showing the Old and New Structures

Automatic Electrical Equipment in Sewage Disposal Plants

A paper on "High tension and automatic electric equipment at the 26th Ward sewage disposal plant, Brooklyn," presented last winter before The Municipal Engineers of the City of New York, Victor Greiff, Electrical Engineer, Bureau of Sewers, Borough President Office, Brooklyn, N. Y., gave the following conclusions:

"In general, it may be said that electrical equipment, of whatever complexity required, for automatic service of every kind, without limit of voltage, can be used successfully in the sewage disposal plant, by

(a) Proper selection of types of standard apparatus,

(b) Protecting certain parts of it in a separate, clean, dry compartment, and

(c) Enclosing other parts in rugged cases."

Special Assessment Procedure for the Construction of Municipal Improvements

Summary of Practice in 24 American Cities

By WALTER MATSCHECK
Director of the Kansas City Public Service Institute

SPECIAL assessments are an important source of funds for the construction of municipal improvements. their amount in some cities exceeds the amount of taxes collected to pay bonds. There are limits on taxes and limits on indebtedness; but fewer limits on the amount of special assessments except for the theoretical one that they cannot exceed the benefits on any certain piece of property. Actually property is sometimes abandoned because of exorbitant special assessments.

In spite of the importance of this source of revenue, very little attention has been paid to the problem. There is little uniformity, and practically no standard of procedure. Many Kansas City property owners felt that they paid higher special assessments than do those in other cities. The present study was made to get the facts in the matter. Questionnaires were sent to all of the larger cities in the country and to a few smaller ones near Kansas City. Twenty-three replies were received. The facts contained in this report are based upon information from the following cities: Philadelphia, Detroit, Cleveland, St. Louis, Baltimore, Los Angeles, Pittsburgh, San Francisco, Buffalo, Milwaukee, Newark, Minneapolis, New Orleans, Kansas City, Seattle, Indianapolis, Rochester, Toledo, Portland, Denver, St. Paul, Omaha, Des Moines, and Duluth.

Theory and Practice of Special Assessments

Types. — Special assessments are levied only when there is a special benefit to the property. This report deals with two types of special assessments.

(a) Assessments on properties within a district created for the purpose to pay part or all of the cost of specified improvements constructed or services rendered within that district. Street improvements are an example. The cost is assessed against the properties in various ways—front footage, area, or valuation.

(b) Assessments on properties benefited by public improvements or services in proportion to, and not in excess of the amount of such benefit. Park purchases are an example in Kansas City. The benefits and assessments are generally determined by a commission or a jury.

Cost vs. Benefit.—Two distinct types of special assessments have come to be confused under the common term of benefit assessments. In the true benefit assessments, an honest attempt is made to measure the probable enhancement in land value which may reasonably be expected as a result of the improvement, and to apportion the costs on the properties affected in proportion to, but not in excess of, these anticipated enhancements. In the other type —which for brevity will hereafter be referred to as a cost assessment—the apportionment of cost is based directly on some physical characteristic of the property which affects cost; such as frontage, for example, in the case of street paving and sidewalks, and area in the case of storm sewers or combined storm and sanitary sewers. Under certain circumstances, the spreads made by the latter method for minor improvements, will conform with reasonable accuracy to a true benefit assessment. In the case of all improvements, however, which benefit an extensive area, as well as in many purely local improvements in sections when the lot lay out is irregular, or the topography uneven, the spread of costs on the basis of physical functions of costs, is not in harmony with benefits.

The legal limitations found in all cities may be fixed by the state constitution, by state law, or by city charter. They regulate improvements and services which may be paid for by special assessments, the method of fixing the assessment, the amount of assessment, the type of property subject to assessment, etc.

There are two methods for the payment of the contractor:

(a) In cash, partly from property owners who pay the assessment in full before or just after the completion of the work, and partly from the sale of special assessment bonds. These bonds are liens against the property and may or may not be guaranteed by the city.

(b) By certificates of assessment. In this case the contractor is responsible for collections and suffers the loss of those that are uncollectible.

Special Assessments in Kansas City. —Under the power of the Kansas City charter special assessments are regularly levied for certain purposes.

Operation and Maintenance of Parks and Boulevards.—This assessment is made by districts at $2.50 per $1,000 assessed valuation of land. In addition, for boulevard maintenance there is an annual assessment of ten cents per front foot of all property fronting on boulevards. These assessments, with the money from automobile licenses, furnish most of the funds for the operation and maintenance of parks and boulevards.

Prior to the adoption of the city gasoline tax in 1923, street repairs were assessed against abutting property on a front-foot basis. Street oiling may be assessed, but never has been assessed in practice.

Improvements.—The following are most frequently paid for by special assessments:

1. Paving.
2. Repaving.
3. Curbing and guttering.
4. Sidewalks.
5. Grading.
6. Street openings.
7. Street widening (with city aid at times).
8. Sanitary sewers (with certain exceptions).
9. Storm sewers (with certain exceptions).
10. Parks.
11. Playgrounds.

Assessments for all improvements, except those involving condemnation, damage or purchase of property, are charged to benefited property by the cost type of assessment. The cost of property damaged, purchased or condemned is assessed against a benefit district according to the benefit type of assessment.

Improvements assessed by the front foot rule include paving and repaving, sidewalks, curbing and guttering. The entire cost is paid including intersections. Corner lots pay full assessment on both fronts. The method of assessing paving and repaving is objected to chiefly because (1) the full cost of repaving arterial highways is assessed, and (2) because corner lots pay a disproportionate part of the cost. There has been some feeling that part of the original paving of arterial highways should be met by the city at large.

Grading is assessed according to assessed valuation of land deemed benefited. Small grading projects are charged against adjoining property to a line half way to the next street. More expensive jobs are paid for by larger districts divided into not more than

three zones and assessed according to; first zone 100 per cent, second zone 50 per cent, and third zone 25 per cent of assessed valuation.

In street opening and widening the cost of property taken or damaged is assessed against property in a certain district fixed by the council. Assessment of benefits is made by a condemnation jury appointed by a judge of the municipal or circuit court. On larger projects, part of the cost may be assessed against the city with the city's consent.

With the exception of three large sewers built recently from bond funds, all sewers of all kinds in Kansas City have been paid for by special assessments. The assessment is spread on an area basis by districts. These districts include the area drained. There is no limitation on the size of the sewer that may be assessed or on the amount of assessment. Sanitary and storm sewers are treated alike. There has been little objection to assessing sanitary sewers in this manner; but such assessment of storm sewers has worked a hardship on high-lying property especially when it is low in value.

The acquisition of property for parks and playgrounds is generally paid by a benefit district, the boundaries being determined by the council and the assessment, by a jury.

Tax Bills and Local Improvement Certificates.—Two types of special assessment securities are used in Kansas City—tax bills and local improvement certificates.

Tax bills are used for all improvements except when property is taken or damaged. The contract always specifies that payment is to be made in tax bills and, after the work is completed and the assessments computed, a tax bill is issued, against each property assessed, in favor of the contractor. The contractor then receives these tax bills and the city's responsibility ends. They may be assigned and are collectible by suit. The amount becomes a lien upon the property. The city treasurer keeps a record of the tax bills issued and includes the amount on the bill for general taxes. Payment may be made to him. This is merely a convenience to the property owner.

The second form of special assessment securities is local improvement certificates and they are issued when property is taken. They resemble special assessment bonds of other cities but are not guaranteed by the city. They bear 6 per cent interest and may not be sold at less than par. The city collects the assessments and distributes the collection pro-rata semi-annually to certificate holders. The city may make up any deficiency from the general fund and in practice usually does so. Due to uncertainty as to the time and amount of payment these certificates cannot compare with city bonds as an investment. An attempt was made in the city charter adopted in 1925 to provide cash payment to contractors and to permit the city to pay deficiencies. A revolving fund was set-up for this purpose. Little has been done, however, toward working out the plan.

The Amount of Special Assessments.—An average of about $2,600,000 has been levied in special assessments in Kansas City during the last ten years. In comparison with other cities Kansas City may be considered neither high nor especially low. Ten of the twenty-four cities considered in this report have higher amounts per capita and ten have higher amounts per $1,000 valuation.

Summary of Special Assessment Practice in 24 Cities

(Information obtained from questionnaires)

Paving.—The method most often used in assessing paving costs is the assessment of abutting property by the front-foot method. It is used completely, however, in only four cities. In several others intersections are paid by the city and the remainder by the abutting property. In ten of these cities paving costs including intersections, are assessed. In six all of the paving except intersections is assessed and in the remaining eight, other methods are used. In Cleveland and Toledo the city pays intersections plus 2 per cent of the remaining cost. In Pittsburgh and Milwaukee the assessment is to the extent of actual benefit and the remainder is paid by the city. In St. Paul the abutting property is assessed for a 12-ft. strip, the balance and intersections being paid by the city. In Newark the assessment varies according to the character of the street, the city paying as high as 80 per cent of the cost. In Philadelphia paving on parkways, boulevards and special traffic streets is paid entirely by the city and on other streets the city pays for intersections and for the work in front of tax-exempt property. In Baltimore part is paid by a special paving tax, part by special assessment, and the remainder by the city.

Sixteen of the 24 cities assess benefits on the front-foot basis, one on the area basis, and four use zones or depth curves. In St. Louis one-fourth is assessed against abutting property on a front-foot basis and three-fourths against a benefit district on an area basis. Pittsburgh and Milwaukee assess on a strictly benefit basis.

In 15 cities only abutting property is assessed. In three cities property half way to the next street is assessed, and in two, property 150 ft. from the paving. In San Francisco and New Orleans all except intersections are paid for by abutting property, intersections being assessed on the frontage of intersecting streets to a distance of one-half block from the intersections. In Duluth for the cost of the paving on the short side of the block, the assessment is spread to the center of the block.

Repaving.—Five cities make no assessment for repaving. In these cases it is paid either from the general city fund or from bond funds. Fifteen cities assess in the same manner as for original paving; but in three of these there is a very slight modification; in St. Louis, if a street is to be repaved within ten years, at least one-fourth of the cost must be paid by the city; in Milwaukee repaving assessments are limited to $3.00 per sq. yd.; and in St. Paul no repaving assessments may be made within 15 years. In Cleveland the city must pay the cost of intersections, plus 2 per cent of the cost of the remainder, plus an amount equal to one-half of the highest previous assessment for paving against that property. In Buffalo two-thirds of the cost may be assessed against benefited property; in Indianapolis, one-fourth may be assessed; and in Toledo, one-half is assessed. There is a tendency in both paving and repaving to modify the rigid plan by lessening the amount of assessment for paving, and dividing repaving between the city and the benefited property.

Curbing and Guttering.—The method of paying for curbing and guttering follows the procedure for paving assessments or is included in the cost of paving, in 20 of the 24 cities studied. St. Paul, however, assesses the entire cost against abutting property on a frontage basis; Denver against a district on a zone basis; Portland against abutting property except corners, which are zoned on an area basis; and in Newark the entire cost is assessed on abutting property.

Sidewalks.—In every city the entire cost of sidewalks is assessed against abutting property in the same way that paving is assessed. In Cleveland and Philadelphia sidewalks are built by the property owner.

Grading.—In 18 cities the cost of grading is assessed by the same method as paving or included in the paving cost. In Kansas City, however, where the topography is rough, only subgrading is included in this cost and main grading is generally assessed against a benefit district. In exceptionally large projects the zoning of districts is used. There is no assessment for grading in Detroit, but very little grading needs to be done. In Indianapolis grading is assessed against a benefit district and may be paid partly by the city at large. St. Paul assesses original grading against abutting property, but large jobs against a benefit district. In Des Moines, when grading is done in connection with street opening and widening, it is assessed against a benefit district; but when it is connected with a paving project it is financed from the general fund. Subgrading is included in paving. Original grading is assessed entirely against abutting property in Newark, and large projects may be assessed against benefit districts created for that purpose.

Street Opening and Widening.—The most common method of assessing for street opening and widening is the creation of a benefit district against which all or at least part of the cost is assessed. In the larger projects it is customary for the city to pay part of the cost.

Sewers.—There is little uniformity in assessing and paying for sewers. One method used is the assessment of lateral sewers and the payment for trunk sewers from bond funds. Another is to limit the assessment against any property to the cost of a sewer sufficient to provide local service to the property, and sometimes the size of the sewer necessary to accomplish this is fixed by law. In some cases lateral sewers are assessed against abutting property and main sewers against a sewer district determined by the drainage area. It is quite common to limit the amount of assessments for sewer construction. Some cities assess on the area basis against sewer districts drained.

Acquisition of parks and playgrounds.—In general the cost of the acquisition of land for parks and playgrounds is met by special assessments. In three cities it is common to pay this cost by assessment against benefit districts. In two others part of the cost is usually assessed by district. In four cities special assessments are allowed but very seldom used.

Park and Boulevard Maintenance.—Kansas City is the only city of the 24 which uses special assessments for the maintenance of parks and boulevards.

Viaducts Over, and Subways Under, Railroad Tracks.—In only three cities besides Kansas City are there special assessments for viaducts and subways made necessary by railroad tracks. In Los Angeles there is a special assessment in some cases; in Seattle in very rare cases a benefit district is created for this purpose; in Portland 20 per cent is usually assessed against a benefit district; and in Kansas City they may be paid for by the railroad, by the city at large, by special assessment, or by some combination of these methods.

Trees.—In 10 cities street trees are planted by the city and assessed against abutting property. In other cities, the trees are either planted by property owners or by the city; in the latter case they are financed from the general fund.

Street Cleaning, Lighting and Repair.—Toledo is the only city that has a special assessment for street cleaning. None of the cities assess the cost of street repair, Kansas City having abandoned the practice in 1923 when the gasoline tax ordinance was passed. For street lighting, 14 of the cities have no assessments; and in the others the cost of original street lighting is paid by the city although ornamental lights and the like are partly or wholly assessed against abutting property.

Water Main Extensions.—No assessment is made for water mains in 13 cities. In two others the water department is privately owned; and in the others a portion of the cost is usually assessed. A common limitation is that not more than the cost of the local mains may be assessed.

Levees.—No adequate information was obtained as to the payment of the cost of levees.

Paving by Street Railway Companies.—In 15 cities the street railway companies pay the cost of paving between the tracks and for a short distance outside. In Philadelphia and Pittsburgh the city is paid a flat sum in lieu of paving. In Baltimore paving is done on part of the system by the railway company. In Indianapolis and Seattle the companies pay the excess over the ordinary cost of paving the area. In Newark the company pays for paving when it lays new tracks and in Denver and Duluth the companies pay no paving cost. There was no information from Milwaukee. In 15 of the cities the companies pay for repaving between and along the outer edges of the tracks. These are the same cities as the 15 listed for original paving, except that Cleveland is omitted and Denver is included. In the remaining eight paving by street railway companies is treated in the same manner as ordinary paving. In 17 cities the companies pay for repairing such paving. In Philadelphia and Pittsburgh they pay a lump sum and in Duluth they pay nothing. In Newark they pay part of the cost and in Baltimore the entire cost on part of the Street railway system. In 14 the company does not pay for the cost of cleaning the street railway areas, and in five it does. Lump sums are paid in Pittsburgh and Philadelphia, and the entire cost is paid over part of the system in Baltimore.

How Is the Contractor Paid?—Payments to the contractor are paid in cash or by tax bills or certificates. For cash payments, funds are raised by the city from collection of assessments, from the sale of bonds or certificates, or from city funds. In the second method, tax bills or certificates are given to the contractor as evidence of the special assessment against certain property. These are in the amount of the special assessment against the specific property benefited and the contractor is responsible for their collection. The cash method is used in 14 cities and the certificate method in five cities. In Philadelphia the certificate method is used except for water main assessments. In Los Angeles it is used in 95 per cent of the cases, and the cash method in 5 per cent. In Buffalo the contractor is paid in warrants payable by the city in from one to five years but callable at any time. In Omaha cash payment is generally used, and in Pittsburgh the contractor is paid by an assignment of the amount due him. The city pays this assignment from special assessments as they are collected, but it must pay the full amount in two years. Unpaid portions of the assignment bear 6 per cent interest.

Assessments may usually be paid in more than one installment unless they are very small in amount. The number of payments varies from one to 20. The interest rate on unpaid assessments ranges from 5 per cent to 7 per cent and sometimes 8 per cent on delinquent installments.

Benefit Districts and Zones.—Boundaries of assessment districts are usually fixed by the council with certain exceptions. Sometimes they are determined by a city board, by some city official, or by a special commission.

Acknowledgment.—The foregoing is an abstract of a report prepared by Walter Matscheck, Director of the Kansas City Public Service Institute.

Effect of Chlorine Treatment on B. O. D. of Filter Effluent

During the past year some investigation was made by the Division of Sewage Disposal of the city of Columbus, O., to determine the effect of chlorine treatment on the biochemical oxygen demand of the filter effluent. The results are summarized as follows by C. D. McGuire, chemist in charge of the division, in the 1927 report:

The test was conducted about as follows: Ten gallons of the liquor to be tested were collected in an earthenware jar. A portion of this was then removed for the determination of the biochemical oxygen demand. The immediate chlorine demand was then determined on a sample from the jar by the method suggested by L. H. Enslow of the Chlorine Institute, using chlorine water and titrating the sample direct with ortho-tolidine on a spot plate as an external indicator.

Chlorine water was then added to the contents of the jar equivalent to the immediate chlorine demand in p. p. m. minus .2 parts. The under dosage was for the purpose of preventing sterilization of the sample. After the addition of the chlorine a portion was then taken from the jar for the determination of biochemical oxygen demand.

These B. O. D. determinations were made for one, two, three and five days at 20 deg. centigrade.

The mean values from 45 determinations are shown in Table I:

Table I

Chlorine demand, 2.32 p. p. m.
Chlorine added, 2.11 p. p. m.

	Biochemical Oxygen Demand			
	1 Day	2 Day	3 Day	5 Day
Untreated effluent	14.2	20.7	25.9	33.0
Treated effluent	4.9	10.2	15.0	19.3
Per cent reduction	65.5	50.8	42.1	41.5

Fig. 1.—Surface Treatment Over Rough Stone Blocks on a Paris Street

Fig. 2.—National Route 20, Chevilly, France, Showing Pentration Macadam Surface Over Old Stone Block Pavement

Fig. 3.—National Route 20 in France. Macadam Resurface 1½ Years Old Over Old Stone Block

How European Worn Out

PAVING practice in European cities differs somewhat from that prevailing in the United States. Some interesting impressions of this work were obtained by Mr. C. L. McKesson, Materials and Research Engineer, California Division of Highways, during a recent trip through the British Isles, France and Germany. We are indebted to Mr. McKesson for the notes that follow.

Surface Treatment Over Stone Blocks.—A very economical method of covering rough stone block pavement is shown in Fig. 1, which is a view taken on a street in Paris. The blocks are first thoroughly washed. They are then covered with an application of about 0.5 gal. per square yard of emulsified asphalt and a covering of screenings ⅜ to ¾ in. in size, using about 25 lb. per square yard. The street should be rolled immediately after the covering is applied. This surface treatment results in a very much smoother street than with the unsurfaced blocks and stands up fairly well under light traffic. For heavy traffic the penetration macadam resurface, as shown in Fig. 2, would probably be more desirable and ultimately more economical.

Macadam Surface Over Stone Blocks.—Figure 2 shows a penetration macadam surface over an old stone block pavement on National Route 20 at Chevilly, France. The surface consisted of ¾ in. to 1½ in. rock spread to a thickness of 2 in. and rolled. The stone chips ⅜ in. to ⅝ in. in size were distributed over the course of stone and rolled in. Emulsified asphalt was applied at the rate of 1.4 gal. per sq. yd. in one application and given a light cover of stone chippings. Rolling was continued until the road was thoroughly compacted. Three weeks after, the surface was washed and the roadway received a seal coat of 0.33 gal. per sq. yd. of emulsified asphalt and another cover of stone chips. It was not rolled after the seal coat. The surface was four months old at the time of taking the photograph. The cost of this surfacing was 60 ct. per sq. yd.

Figure 3 shows a macadam resurface 1½ years old, over old stone blocks on National Route 20 in France.

Penetration Macadam Resurface on Old Macadam Base.—An interesting example of a penetration macadam resurfacing over an old waterbound macadam base is shown in Fig. 4, which is a view of Graft Recke St., Dusseldorf, Germany. This is a heavy traffic street leading to brick and tile factories and much of the traffic consists of motor trucks. The street has two roadways, separated by parking, shown on the left in Fig. 4. It was found difficult to

Cities Utilize Pavements

maintain this street as a macadam road and in 1925 the surface on the half of the street shown in the illustration was scarified, reshaped and then covered to a depth of 1.6 to 2½ in. with clean crushed stone. This stone received a first treatment of 1.1 gal. per sq. yd. of emulsified asphalt and a second coating of 0.66 gal. Between applications it was covered with soft sandstone chips and rolled. After the next application the surface was covered with sand and fine soft gravel. The finished thickness of the macadam resurface is approximately 2 in. At the time the photograph was taken the street had been in use two years and it is said not to have any maintenance in this interval. About 100 streets in Dusseldorf has been treated by the method described above.

Emulsified Asphalt Treatment Over Old Macadam.—Figure 5 is a view of Avenue de la Car at Chateauvoux, France. This street is constructed of an old macadam, which was reshaped in 1926 and covered with 1½ in. to 2 in. limestone to a thickness of about 3 in. This crushed stone was rolled lightly and covered with about 40 lb. per sq. yd. of ⅜ in. to ⅝ in. stone chips. A treatment of 1.3 gal. per sq. yd. of emulsified asphalt was then applied, followed by a light cover of stone chips and rolled to a smooth uniform surface. Three weeks later the street was given a seal coat of 0.44 gal. per sq. yd. of emulsified asphalt with a light cover of stone chips. The Avenue de la Car is a main street leading to a depot and receives heavy and continuous traffic. Fourteen months after the completion of the work above described, and about a week before the photograph was taken, the street was washed thoroughly and given an application of 0.33 gal. per sq. yd. of emulsified asphalt and a cover of about 17 lb. per sq. yd. of stone chips.

Surface Treatment on Old Macadam.—The illustration, Fig. 6, shows a surface treated macadam on a Paris street after 16 months' service. The waterbound macadam in this case was cleaned with water and brooming and was treated with 2 qt. of emulsified asphalt per sq. yd. The street is adjacent to warehouses and factories and is used almost continuously by truck traffic. After 16 months the surface coating was beginning to wear through in spots, but was not broken or potholed. The recommended retreatment of such work consisted of cleaning the surface thoroughly and of applying a fresh application of about 2 qt. per sq. yd. of emulsified asphalt, followed with a covering of stone chips in the amount of 15 to 20 lb. per sq. yd.

Fig. 4.—Graf Recke St., Dusseldorf, Germany, Showing an Interesting Example of a Penetration Macadam Resurfacing Over an Old Waterbound Macadam as a Base

Fig. 5.—Avenue de la Car, Chateauvoux, France. Emulsified Asphalt Treatment Over Old Macadam

Fig. 6.—Surface Treated Macadam on a Street in Paris After 16 Months' Use

Fire Hydrant Rental Bases Mostly Arbitrary

Replies to Questionnaire Sent to Water Works Superintendents

TO help along the general study of public fire protection service, Municipal News & Water Works sent out a questionnaire to some eighty waterworks superintendents, about half privately owned plants and half municipally owned, from whom we wished to get a statement of the basis used in computing fire hydrant rentals. The results of the questionnaire show that of all but one of those plants reporting, the charge was arbitrarily established.

There are three general methods employed for paying for public fire protection service, viz.: (a) hydrant rental, (b) charge per mile of pipe (4-in. or 6-in. and larger) with an allowance per hydrant for maintenance, (c) charge per inch-foot of pipe (4-in. or 6-in. and larger) with an allowance per hydrant for maintenance. The first one of these methods predominates to such a degree it was thought that perhaps there was some definite basis upon which the charge was computed. The cost of installing hydrants on existing lines as well as on extensions and in new developments or subdivisions is handled differently throughout the country.

The table on this page was compiled from the replies which were received from the questionnaire sent out.

It would perhaps be interesting to read the various replies for data which a table naturally obscures. They follow:

Fairhaven, Mass.—Ours is a private company. The town pays us $50 per hydrant per annum, which we think is too low. In new developments which do not offer sufficient revenue we have petitioners sign a contract guaranteeing 12 per cent on cost of mains and hydrants for 10 years.—H. T. Gidley, Supt.

Baltimore, Md.—There is no charge made for the use of fire hydrants in the city of Baltimore. This Bureau is financed on the budget system, which is appropriated from the general city funds. The difference between the water service revenue received and the operating expenses (of which the use of fire hydrants is one item) is taken from the tax levy.

The cost of installing new fire hydrants is included in the construction cost of the distribution system and is financed out of the Water Loans, for which the interest and sinking funds are taken from the general city funds, including water service revenue and tax levy.

We charge a fire hydrant rental of $36 per annum for fire hydrants on city owned mains in the Metropolitan Dis-

Hydrant Rental and Construction Cost Basis

Town State	Ownership	Hydrant Charge: Basis	Hydrant Charge: Per annum	How New Construction Costs Paid	Remarks
Baltimore, Md.	M	Arbitrary	$36[1]	Water loans[3]	Charged to construction costs of distribution system
		Arbitrary	$24[2]		
Knoxville, Tenn.	M	Arbitrary	$45	Paid by separate account out of water department revenue	Not assessed to property
Charleston, S. C.	M	Arbitrary	$50	Charged in with distribution system construction cost and paid by water department revenue	Hydrants in excess of 600 bring return of $25 each
Providence, R. I.	M	Arbitrary	$30	Charged in with cost of distribution system and paid by general fund	
Sacramento, Cal.	M	Arbitrary	$1 per mo.	Charged in with whole cost and paid by general bond issue	
Thompsonville, Conn.	P	Contract	$25 to $50	Investment about 10 times annual rental charge	Town pays for cost of installation in excess of 10 times rental
Oskaloosa, Ia.	M	Arbitrary	$50	General waterworks fund	
Selma, Ala.	M	Arbitrary	$45	Water department revenue	No assessments made for new construction
Bluefield, W. Va.	P	Contract	$100 on new lines	Paid by company	State commission fixes rates
		Contract	$22.50 on existing lines		
Mountain Home, Idaho	M	Arbitrary	Amt. not stated	No new construction	
Rumford, Me.	P	Flat charge of $10,000 per year made on corporation 108 hydrants in service now. New ones added without additional charge			
Kansas City, Kan.	M	Arbitrary	$35	Water department revenue	Department has about 1,500 hydrants in service
Salisbury, N. C.	M	Arbitrary	$35	From water department revenue and bonds provided by city as whole	Total amount charged city is less than 20% of total revenue
Springfield, Mo.	P	Contract	$60	By company	One hydrant authorized for each 600 ft. of extension
Fort Collins, Colo.	M	None		In with distribution system and assessed to property	New hydrants on existing lines paid for by water department revenue
Pocomoke City, Md.	M	None		Borne totally by city	
Carroll, Ia.	M	None		Paid by city in general	
Leavenworth, Kan.	M	Arbitrary	$75	Water department revenue	
Elkhart, Ind.	M	Arbitrary	$4 per mo. to city, $5 per mo. to private concern	Water department revenue and bonds	Charged in with cost of distribu- construction cost of distribution system
Kewanee, Ill.	M	Arbitrary	$30	Charged in with account of distribution system and assessed to abutting property	City pays 25% of all improvements
Anthony, R. I.	P	Contract	$25	Paid by company	Hydrant installation charged in distribution system construction cost
Fairhaven, Mass.	P	Contract	$50	Paid by company	On new developments company has petitioners guarantee 12% of cost of mains and hydrants for a period of 10 years

Footnotes:

[1]This charge is for fire hydrants on city owned mains in the Metropolitan District outside of the city limits. It is compiled as follows:

$ 6.00	Operating and maintenance expense
15.00	Interest and sinking fund on investment
15.00	Water service and readiness-to-serve charge
$36.00	Fire hydrant rental per annum

[2]Special charge to Metropolitan Commission because they float bonds to pay for installation construction costs and carry interest and sinking fund charges. They assess abutting property 15 ct. per foot to cover interest and sinking fund.

[3]Interest and sinking fund for these loans are taken out of the city general fund.

trict outside of the city limits. This charge is compiled as follows:

$ 6.00	operating and maintenance expense
15.00	interest and sinking fund on investment
15.00	water service and readiness-to-serve charge
$36.00	fire hydrant rental per annum

The Metropolitan Commission also installs mains and fire hydrants in the Metropolitan District for which they float bonds and assess abutting property 15 ct. per front foot to cover the interest and sinking funds. The city receives a rental of $24 per annum for these fire hydrants. The difference between the two rental rates ($12) represents a reduction allowed the Metropolitan Commission for financing the installations and carrying the interest and sinking funds.—Edward G. Rost, Water Engineer.

Fort Collins, Colo.—You ask on what basis our hydrant rental is fixed. Will answer, we have no rental charge.

You ask how we assess new construction fire hydrant costs, whether in the cost of construction to be assessed on the front foot basis or as a levy on the city as a whole. Will answer that unless the hydrants come in as a part of a regular water improvement district they are charged out of the regular waterworks department fund, otherwise as a part of the cost of a particular improvement district, to be charged to the property specifically benefited in the district.

For your further information, will say that our waterworks is municipally owned.—E. A. Lawson, City Engineer.

Charleston, S. C.—The question of hydrant rental charges is very much one of "Topsy"—that is, it has just grown up.

In our case at Charleston, the municipal department pays us a fixed sum for a number of fire hydrants, which includes the use of 300,000 gal. of water per day for municipal purposes, flushing sewers, sweeping streets, police station, city hall, etc. Neglecting the use of water this nets us about $73.30 per hydrant, but the 300,000 gal. on our regular schedule of rates amounts to $13,900 per year, which deducted from the contract amount, would reduce the amount paid for hydrant rental to $50 per annum.

For all hydrants in excess of the first six hundred, we charge a flat rate of $25 per hydrant, which just about carries the cost of maintenance, depreciation, and interest on the hydrant installation.

In making extensions for real estate developments, etc., we charge the cost of setting hydrants, including the cost of hydrant and hydrant leads, right into the cost of the extension. Of course, we keep a detail of this cost, but so far as the plant account is concerned, there is no distinction made. Rental on these hydrants is the same as for public hydrants provided they are located on the public highways; however, if they are put in private ground off the highway, we make a charge for the size main leading into the property, and the property holder can put as many hydrants on this main as he sees fit. All water, however, passes through and is measured by Protectus type of meter, and we make no charge based upon the number of hydrants.

The Water Department pays for all mains, valves and hydrants in the streets if laid within the city limits on developed streets, but in new developments we require the real estate development company to pay the cost of these developments, and then as consumers are obtained we reimburse the development company a pro-rated or agreed amount, depending upon the size of service and the minimum guaranteed yearly rental.—J. E. Gibson, Manager and Engineer.

Kewanee, Ill.—We make a charge of thirty dollars per hydrant per year against the city, which is credited to the Water Department. The costs for new fire hydrant construction is charged in with the cost of construction of the distribution system, and the whole thing is assessed on a front foot basis against the abutting property. The city standing twenty-five per cent of all public improvements.—R. M. McKinley, Assistant Superintendent Water Works.

Elkhart, Ind.—Public fire hydrant rental is $4 per month, paid by the civil city; private fire hydrant rental is $5 per month, paid by the consumer. We charge the costs of construction in the distribution system and all of our constructions are direct liabilities of the waterworks paid from proceeds of bond issues or from revenues. The civil city does not stand any part of the cost. —J. R. Stephenson, Superintendent.

Leavenworth, Kan.—Our water department charges the city the sum of $75 per annum for each fire hydrant installed. This however, is an arbitrary charge and is not based on any particular basis. We figure that the city should pay us for the privilege of having ample fire protection at all times and the water as well as the fire hydrant is there for their use at any time.

This amount of rental paid to the water department is provided for by a tax levy and is paid by the general taxpayer to the city treasurer and in turn is paid over to the water department when we present our quarterly statement for hydrant rental.

The water department installs the fire hydrants at their own expense and this does not cost the city any extra, but is charged in on the cost of construction of our distribution system.—Chas. F. Linck, Superintendent.

Anthony, R. I.—Ours is a private plant. Hydrant rentals are $25 per year. All hydrant installations are charged to construction. We do not (in fact, cannot) under our contracts charge fire line extensions to the abutting property.—J. W. Money, Superintendent.

Carroll, Ia.—We have a municipal plant and make no charge for hydrant rental except to private individual, circuses, etc. New fire hydrant construction costs are charged in the extension costs.—H. W. Badley, Water Superintendent.

Pocomoke City, Md.—We do very little in way of fire plug rentals. What little is done is on a temproray estimated arrangement. We have no assessment on fire plug installations. The city assumes the total cost. Our plant being municipally owned, the cost of installing and maintaining is borne totally by the city.—R. H. Robertson, Superintendent.

Springfield, Mo.—This company is privately owned, and we have an arrangement under our agreement with the city to install a fire hydrant for every 600 ft. extension of 6-in. or larger main. In other words, the city can authorize or direct us to install fire hydrants either on existing mains or at new locations, requiring extensions of not more than 600 ft. for each fire hydrant ordered. We receive in return for this extension a rental of $60 per year from the city, but no charges whatever are made to property owners or the city for the construction work.

The entire cost of the construction is entered into our distribution system account, which is a plant charge.

For new services we allow the consumer 75 ft. for each new service, or that is, inside or outside the city limits, anyone desiring service not within the reach of present mains is allowed 75 ft. free of extension for each service and a cost of 45 ct. per foot for the balance. —William J. Gray, Superintendent.

Salisbury, N. C.—We do not actually collect anything through taxes from the city for fire hydrant rental, street flushing, or sewer flushing. However, the city does pay the interest on bonds and takes up the bonds as they fall due. So to cover this situation we set up a charge against the city for this service and then credit them for the service they render in handling the bonds. On this basis we figure the hydrant rental amounts to approximately $35 per hydrant per year.

The new construction work, whether for hydrants or otherwise, is paid for from our revenue or through bonds provided by the city as a whole. We do not assess any main line costs against the property, but if a small service stub is put in on account of paving the tap fee as assessed along with the paving costs and the water department collects when the work is done from the paving account.

The total amount we charge against the city for hydrant rental, street and sewer flushing amounts to less than twenty per cent of the total revenue for the year.—J. O. Craig, Superintendendent.

Kansas City, Kan.—Our department

has approximately 1,500 fire hydrants for which they receive $35 per hydrant per year, which is paid out of the Protection of Life and Property Fund of the city government.—H. T. Barclay, Superintendent of Water.

Rumford, Me.—We charge the cost of installation of hydrants to our Plant Account and then charge the Rumford Falls Village Corporation a flat rate of $10,000 per year. At the present time there are 108 hydrants in use by the corporation and we add necessary ones without additional charge. Ours is a private plant.—F. O. Walker, Superintendent.

Mountain Home, Idaho.—Hydrant rental was fixed by a former Board of Village Trustees and same followed to date. No one knows the basis upon which it was originally fixed. We have had no new construction in fire hydrant extension for a number of years; think it was taken care of by assessment by the town as a whole.—A. F. Anderson, Village Clerk.

Bluefield, W. Va.—Hydrant rentals for this property have been fixed by State Commission, basing the charges for fire protection service on the investment in plant for such service over and above the investment that would have been made to furnish water service without fire protection.

The city pays us a fixed charge for hydrants as of a certain date. On all new hydrants ordered in on new extensions laid for such service, we collect at rate of $100 per year regardless of size of hydrant.

On all new hydrants ordered in city on existing lines, city pays us rental of $22.50 per year.—S. L. Rhoods, Superintendent.

Selma, Ala.—We charge $45 a year rental for fire hydrants. As to how we arrive at a basis beg to say that we simply charge this, as we consider it a fair rental, and it is, I understand, what most water companies charge.

We make no assessment against the property or the city or anyone for fire hydrants where the consumption of water is sufficient in any location to require a water main. When this main is laid fire hydrants are placed not farther than 500 ft. apart and there is no charge made for them, the water company furnishes them.—R. Coleman, Manager.

Oskaloosa, Ia.—We make a charge to the city of $50 for each fire hydrant. The construction cost is paid out of the General Water Works Fund and there have been no mains laid here yet under the assessment plan. We believe the assessment basis is probably the most fair way if the law could be simplified enough to be practically used with a small office force which is accorded our water works department.—H. C. Hawkins, Superintendent.

Thompsonville, Conn.—Our hydrant rentals are based on a fixed sum per hydrant, ranging from twenty-five dollars to fifty dollars. We will invest in construction for additional hydrants, including necessary extension of main required, an amount equal to about ten times the annual hydrant rental charge.

Should the cost of the hydrant including main extension exceed this amount it is paid for by the town. This is a private company.—Walter P. Schwabe, President and General Manager.

Sacramento, Cal.—The charge for hydrant rental is one ($1) dollar per month per hydrant. This charge is made against the fire department.

Hydrants are installed when extension work is carried on and financed through general bond issue.

Sacramento has municipally owned water.—J. I. Prugh, Superintendent.

Providence, R. I.—The yearly charge of each fire hydrant is $30 per year, for city or town.

The cost of construction of fire hydrants is charged in cost of construction of distribution system:

Water pipes are laid in streets under the following city council resolution:

RESOLVED, That the Commissioner of Public Works is requested to reject any application for water pipes to be laid in the streets of the City of Providence and adjoining towns unless the estates abutting upon said streets are sufficiently built upon to ensure an annual income from the sale of water to be not less than seven per cent of the cost of the water pipes and the laying thereof. Wherever owners of land that is not built up enough to pay said income desire to have water pipes laid, they may have such work done by the city by depositing with the City Treasurer a sum of money sufficient to cover the cost thereof. And if at the expiration of ten years or less from the time said pipes are laid there shall be a sufficient number of takers of water who shall annually pay into the City Treasury a sum of money equal to the amount required by the city, if said city had furnished and laid the pipes at its own expense, then said city shall pay to the owners of said pipes the amounts that were paid by them into the City Treasury.—Ornam L. Patt, Jr., Secretary.

Knoxville, Tenn.—When the water plant of the City of Knoxville was owned by a private corporation, the Court authorized and permitted them to charge the city $45 per annum per hydrant, for public hydrants installed. In setting up the fire hydrant rentals contained in the Rates, Rules and Regulations, approved by the Council, May, 1925, the city officials in charge of the Water Department simply revived the rental authorized and paid to the private company. We checked this charge and found it was a fair average of other cities.

New fire hydrants installed are paid for by the Water Department of the City of Knoxville out of its own revenue. The cost is not assessed against the abutting property or any other institution, but entirely against the Water Department revenue as set up in its own budget.

The cost of installing new fire hydrants, as well as maintenance and repairs to old fire hydrants, are charged to a separate budget item in the Water Department's budget, and not to the distribution system construction costs, and not through an assessment on front foot basis against the abutting property or in any other way.

We know that the above procedure is not that followed by a number of other municipalities, or by a number of privately owned water works.

The Water Department in Knoxville is in debt to the general fund of the City for deficits arising prior to existence of the present city manager form of government on Oct. 1, 1923, and subsequent to the purchase of the privately owned plant in 1909. The fire hydrant rental therefore, which is annually charged against the City by the Water Department, becomes a bookkeeping account only and is applied to the general reduction of the Water Department debt to the City. What will happen when the Water Department's debt to the City is finally paid in full, remains to be seen.

At the present time the people of Knoxville consider the fire hydrants as a part of the fire fighting equipment and covered by the taxes they pay to the City for fire, police, streets, sewers, etc.

From my knowledge and experience, the majority of cities throughout the United States, regardless of whether the Water Department and water works is owned by the City or by private corporation, have fire hydrant charges which have no more logical basis for existence than that here in Knoxville.

The Indianapolis Water Company, 113 Monument Pl., Indianapolis, Ind., F. C. Jordan, Secretary, is operating, however, under an entirely different order of affairs. The State Public Service Commission passed regulations effective January 1, 1925, which makes the City pay for public fire hydrant service on the inch-foot basis.—Frederick W. Albert, Engineer in Charge of Water Department.

Cities Defining Their Metropolitan Areas.—In preparation for the forthcoming census of 1930, 72 cities are defining their metropolitan regions in order that the returns may be compiled hereafter to show the rate of growth for such units. Among the cities defining such areas, reports the Civic Development Department of the Chamber of Commerce of the United States, are New York, Chicago, Detroit, St. Louis, Philadelphia, St. Paul, Minneapolis, Dallas, Buffalo, Rochester, Kansas City, and others. Twenty-one metropolitan-area maps are in preparation or have been made.

Pulling the Cork From a City's Bottle-Neck

How San Francisco Opened Up Its Main Outlet

ONE of the most outstanding pieces of highway construction yet built by the California State Highway Commission, and the widest cement concrete "super-highway" on the state system has recently been completed on the El Camino Real south of San Francisco. The stretch extends for approximately 1½ miles between Colma and the Cypress Lawn Cemetary, formerly a section notorious for its ability to congest traffic in the narrow defile. Due to this notoriety the section gained the name of the "bottleneck highway."

City's Main Outlet.—This is a section of San Francisco's main outlet and the only state highway serving the city. It has the record of being the heaviest traveled road in the entire state of California, a count indicating a volume of 20,000 vehicles per day. The pavement selected for the improvement is one of the heaviest built to date—a thickness of 9 to 11 in. of Portland cement concrete. The improvement consists of two 30 ft. strips of pavement, one on each side of the Market Street Railway Company tracks. This width allows for three lanes of travel in each direction with a 10 ft. allowance for each lane. Predictions that the road would carry future traffic with increased speed and safety are being borne out.

Total Cost $700,000.—The cost of right-of-way, grading and realigning the road was the major item of cost in the total improvement which approximated $700,000. Many months were taken after the dedications were completed to move buildings and other obstructions. Realignment of all the poles of the railway, telegraph and telephone companies greatly improved the appearance of the highway.

124 Ft. Right-of-Way.—The first contract was let in October, 1926, for rough grading and moving buildings, etc. This award was made to the Kaiser Paving Co., of Oakland. The improvement provides for a right-of-way of 124 ft. and in some cases whole blocks of substantial buildings were moved. During all the grading and moving work, traffic was maintained over properly surfaced roadways. The organization of this part of the work was one of the features of the project during construction.

Contract for paving the highway was awarded June 23, 1927 to the Hanrahan Co., contractors, of San Francisco. The width of the former road was only 24 ft. for traffic in both directions and when the paving operations were started it was an unusual sight to view the narrow sufaced portion of the wide, spacious right-of-way. With the 24 ft. roadway congested, the sight was conclusive as to the value of wide, straight highways with ample pavement surface.

With the procedure of the work, the Market Street Railway Co. moved its tracks to a 28 ft. section at the center of the right-of-way. The tracks were ballasted in rock and not paved. A curb along the pavement prevents travel in the railway area except at specified crossings.

Construction Methods.—On each side of the track area, there was constructed a 30 ft. portland cement concrete pavement, consisting of three 10 ft. strips, each 9 in. thick in the central 6 ft. and increasing from 9 to 11 in. at the edges. The strip adjacent to the center was built to a width of 10 ft. 9 in., the additional 9 in. being for support of a concrete curb doweled to the pavement base.

Each 10 ft. strip was placed and cured before the adjacent strip was placed, to facilitate finishing operations. Materials were batched direct in compartment trucks from bunkers which had been set on a railway siding near the center of the work. The batches were hauled to a 6-bag Multifoote

View of Colma-Cypress Lawn Highway Improvement

The Improvement Provides Two 30 Ft. Strips of Pavement on Each Side of the Railway Tracks

paver which traveled along to place the concrete directly in the 10 ft. strips. One of the first operations was to pave the section in a new line change to permit the moving of tracks and allow travel to use the new portion quickly. At the same time eliminations were made of two dangerous track crossings.

Expansion Joints 60 Ft. Apart.—The design of the concrete pavement provided for expansion joints at 60 ft. intervals. Adjoining slabs at these points were doweled together with five ¾ in. by 24 in dowels through the premolded filler. These dowels were so placed as to be fixed at one end and permit movement in the other end. At 20 ft. intervals between expansion joints, weakened plane joints were constructed to obtain a straight transverse natural crack line; therfore each 10 ft. by 20 ft. portion of the pavement is separately reinforced. The weakened plane joints were formed by slotting the pavement surface and inserting in a vertical position a metal strip ¼ in. thick, 2 in. wide and 10 ft. long. After finishing operations had passed over, the strip was pulled to the surface and left to protrude about an inch until the pavement had set. The pavement was edged at these points and the slot filled with hot asphalt before being opened to traffic.

Pavement Reinforcement.—Reinforcement consisted of marginal bars in each 20 ft. panel of two ⅝ in. deformed bars laid 4 in. from the sides of the strip and the same distance from the expansion or weakened plane joints. 30 ft. bars were used and where joined were lapped 40 diameters. In one section where the new construction topped old pavement, the concrete was reinforced with ⅜ in. square deformed bars laid in mats with 12 in. spacing.

Finishing and Curing.—Finishing operations involved the use of strike boards and tamper, and floating with longitudinal float 16 to 18 ft. long operated across the pavement with the length of the float parallel to the center line of the pavement. The final finish was made with another float built of lighter wood, 16 to 18 ft. long, equipped with reversible handles. This floating was done when the concrete became slightly sticky to produce the best in non-skid finish.

Curing followed with an earth cover and ponding for eight days. Strips were opened at 14 days provided the modulus of rupture was at least 400 lb. per square inch as determined by flexure tests. Specimens for the test were cast 7 to 10 in. and 38 in. long, and three specimens were made for each ½ miles of pavement.

The construction of the "bottleneck" highway was a cooperative project with combined sharing of costs between city and county of San Francisco, County of San Mateo and the Market Street Railway in amounts of $150,000, $50,000 and $55,000 respectively. The construction was done under the supervision of District IV, California Highway Commission, J. H. Skeggs, District Engineer.

Patrol Street Cleaning at Toronto, Ont.

Extract from 1927 Report of George W. Dies, Street Commissioner of Toronto

The streets are the show windows of the city. Any neglect to keep them well paved or reasonably clean is apparent to all who use them, but particularly to visitors. We therefore should not be too sparing in the maintenance and performance of these important duties. The patrol work is perhaps the most important branch of the street cleaning service, which embodies as well the flushing of streets, the cleaning of culverts, the oiling of unimproved roadways and the removal of snow.

The downtown business area and main business thoroughfares are under the patrol system; that is, each patrolman has a defined area to patrol, which may be covered from one to eight times a day, according to its requirements. Each patrolman is provided with a paper-picking bag, push cart, broom, scraper and shovel. He covers his beat on the first round each morning with the paper bag and removes all loose paper which may be on the boulevard, walks, or roadway. He then commences his rounds, removing all street dirt which is deposited in the push cart. As the tubs are filled, they are left at a designated point, to be later picked up by a truck.

The remaining sections are under the squad system; that is, the men work in pairs, one on each side of the roadway, followed by a pick-up vehicle. This system is carried out in the residential and outlying sections. The various districts receive a cleaning once or twice weekly according to its requirements and the funds available.

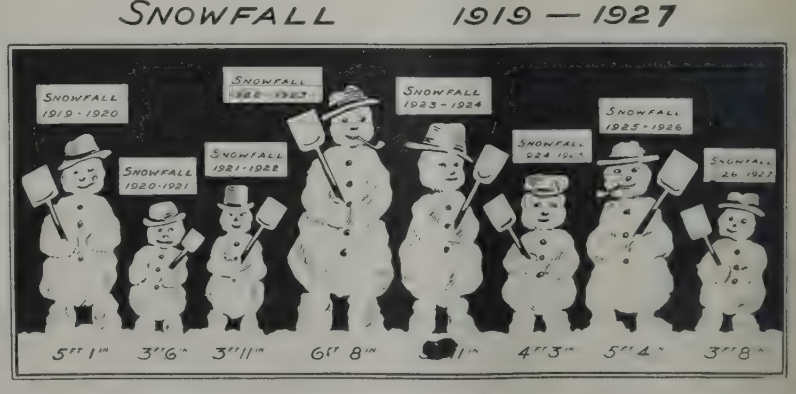
The streets of Toronto, prior to 1916, received constant cleaning, each patrolman having an average of 1.4 miles of street to maintain. This average has, however, increased each year, due to reduced estimates and a gradual increase in the wage rate, so that today the average mileage maintained by each patrolman is 3.4 miles, covering approximately 42,000 sq. yd. While there was an increase from 167 patrolmen in 1926 to 175 in 1927, it was not sufficient to cope with the new districts which have been developed during the year. The average mileage maintained by each patrolman is greatly in excess of the mileage that can be properly maintained by one man.

Statement Showing the Unit Cost of Hand-broom Sweeping of Improved Roadways for 1927

Total cost (foremen, labor, cartage, supplies)	$262,939.44
Area of improved street mileage (square yards)	7,494,857
Cost of maintenance per 1,000 sq. yd. per season	$35.08
Amount of sweepings collected (cubic yards)	95,042
Cost per cubic yard (sweeping, collecting and removing)	$2.75
Cubic yards removed per 1,000 sq. yd. per season	12.9
Number of patrolmen	175
Average area maintained per patrolman (square yards)	41,898
Average number of times swept per season	90
Cost of sweeping per 1,000 sq. yd. (sweeping, collecting and removing)	$0.389

The Typhoid Fever Carrier Again Gets a Job in the Dairy

The Secretary of the Department of Public Health of Vermont reports an epidemic of typhoid fever in the city of Rutland, Vt., from March 25 to April 14, 1928, which was traced to a healthy carrier employed in a dairy. There were 15 primary cases, 1 secondary case, and 3 deaths. The carrier was 63 years of age and gave a history of typhoid fever when about 15 years old. Eighteen years ago he developed cholecystitis and was operated upon with the removal of a number of gallstones. Since that time he has been apparently well.



Yes! It Snows at Toronto, Ont. Here is a Graphical Representation of Just How Much It Snows. Used by George W. Dies, Street Commissioner, in His Annual Report to Show Comparative Snow Falls Since 1919

Maintenance of Sanitary Sewers and Storm Drains

Methods Employed on Sewer System of Baltimore, Md.

By Milton J. Ruark
Sewerage Engineer, Bureau of Sewers, Baltimore, Md.

THE need for maintaining sewers and drains is usually the result of one or more of four causes: Poor design, poor construction, depreciation, and in some respects the most important of all—misuse.

Poor Design.—The question of the poor design of sewers in Baltimore, where careful study and thought are devoted to relatively unimportant sewer projects, is practically of no importance in so far as the maintenance of the sewers is concerned. Care must be given in selecting the proper materials for construction, and sewers of adequate size and strength should be planned. Except where unusual problems present themselves, the planning of sewers and drains has become so standardized that there is little excuse for poor designs.

It is fortunate that practically the whole of the sewerage system of Baltimore has been planned and built as one project during the past 20 years at a time when the theories relating to sewer design had been perfected. The result has been that the sewers have been adequate in size, and it has not been necessary to replace the materials of which they were built. The most conspicuous case where a more desirable design would have been preferable relates to storm water inlets at street intersections. Many of the covers on these inlets are broken and crushed by trucks or vehicles hitting or running over them. Inlet covers formerly had a radius of six feet. The remedy has been to increase this radius to 10 or 15 ft. This change in design not only corrects the difficulty, but also permits vehicles in the street to turn at corners with greater ease.

Poor Construction.—It is as essential to have good construction as it is to use careful design in order that maintenance costs may be kept at a minimum. Two of the most essential things to watch in the construction of sewers is to see that the material used for backfill is thoroughly compacted under and around the pipe and that the joints are well made. The former precaution will add much to the strength of the sewer, and tend to prevent failures.

A Root Proof Joint.—Tight joints not only reduce the quantity of ground water entering the sewers to a minimum but also help to exclude tree roots. Fully 35 per cent of the chokages in the sanitary sewers of Baltimore are due to the roots of poplar and willow trees. Many times roots grow long distances to reach sewers. The roots of oak and similar shade trees have never been known to give this trouble. In each place where a sewer becomes choked because of tree roots the joints, through which the roots have passed, are remade with great care. First, a ring of jute is inserted in the bell of the pipe the same as when the usual Portland cement joint is made. Then red and puddle clay, to which has been added a liberal quantity of coarse salt, is packed over the jute to within about ½ in. of the end of the bell. On top of this is placed a mortar of cement and sand. This type of joint has proved effective since none has ever been replaced because of the entrance of tree roots. Fortunately, this problem is getting better, as there is now a city ordinance which prohibits the planting of poplar trees on public highways.

Maintenance Due to Depreciation.—The maintenance required to keep a sewer system in first-class condition is usually not great, especially if the system is new. However, there are numerous factors which tend to increase the gradual depreciation of sewers. Other public utilities such as gas and water pipes, electric conduits, etc., are often constructed in trenches adjacent to the sewers, and not infrequently the latter are damaged due to a settlement of earth or other causes. It is sometimes weeks or months before the trouble is discovered and rectified.

The tapping of sewers by plumbers to provide for additional house connections often causes trouble that makes itself evident by a chokage near the tap. One way to remedy this difficulty is to inspect thoroughly every new connection.

A great deal of the general maintenance work consists in replacing noisy and broken manhole covers and making repairs to inlets. Where sewers are well designed and constructed, and are not old, little money need normally be appropriated or spent to remedy wear and tear.

Maintenance Due to the Misuse of Sewers.—Although a sewer system is designed to have a very limited use, it usually becomes the repository for almost every conceivable object of moderate size. If a man gave so little thought to his telephone or electric light service as to the use of the sewer system, neither of these public utilities would function as well as they now do. The following is a list of some of the things which have been removed from choked sewers: Hatchets, bricks, bird cages, corn cobs, flat irons, pick handles, dish pans, shoes, oyster shells, table spoons, broom handles, whiskey flasks, brushes, garden hose, coffee pots, dead cats and dogs, dolls, etc. It seems inconceivable how some of these objects get into the sewers. Pick handles, which are frequently found in sanitary sewers, have most likely been left there by some laborer after the completion of the sewers.

Maintenance of Storm Drains.—One of the first rules that must be followed in order to reduce the maintenance of storm drains is to keep the streets clean. Unless this policy is followed the debris on the street is washed into the drains after the first heavy rain, where it often has to be removed at considerable cost.

Furthermore, the material at dumps, the drainage from which flows into the upstream end of storm sewers, should be kept from rolling or obstructing the drains.

Some few years ago quantities of dead fish, which decomposed and gave off odors, were found in the drains adjacent to some of the markets. It was learned that these fish were washed into the storm sewers, usually late at night, when the markets were being cleaned. Since this practice naturally created a good deal of trouble, the markets were patrolled for a short length of time, and the difficulty was remedied.

Disposal of Snow Into Drains.—In most large cities the disposal of snow into storm drains has become a generally accepted practice. Frequently the snow has mixed with it garbage, ashes and debris found on the streets. The snow melts in the drain and often leaves these foreign materials, which have to be eventually removed, stranded on the bottom of the sewers. Large drains should be selected for the disposal of snow, and liberal quantities of water used for flushing purposes. A 36 in. drain in Centre street became completely blocked with frozen snow last winter, and considerable difficulty was experienced in removing the material.

Disposal of Oil and Gasoline in Drains.—One of the most serious problems that confronts engineers who have

charge of the maintenance of sewerage systems relates to the disposal of gasoline and oil from automobile crankcases into the sewers. The problem is an ever present one not only in Baltimore but also in practically every large municipality in the country. Many cities have had serious explosions because of the ignition of gasoline in the sewers. On June 8, 1926, there was an explosion and fire in the Jones Falls drain, but fortunately, no serious damage resulted.

Immediately after the fire, efforts were made to enforce the ordinance which prohibits the discharge of oil and gasoline into the sewers. Many inspections were made of those drains and sewers tributary to that portion of the city where there were large numbers of automobile establishments. As it was impossible to police each public garage in the city, conditions were not improved. It was recognized that the only remedy was to provide the garages a way of disposing of the spent crank-case oils. As a result the city entered into a two-year contract with the Provident Oil Service at a cost of $3,240 a year for disposing of the oil from garages and similar places. This company collects the oil at regular intervals and disposes of it.

Cleaning Large Drains.—A minimum of time and money is spent in order to remove the material which settles in large drains. The velocities in them during dry weather are such that there are considerable deposits. The first heavy rain, however, flushes out this sediment, and the problem solves itself.

As a general thing there are practically no odors coming from storm drains. Occasionally there are odors from a few inlets, caused by a dead animal or other decomposing material being present. Disinfectants and deodorants are used at times when odors are pronounced.

There are certain drains and also sanitary sewers, the design and construction of which require frequent inspection and attention to see that they are in good working order. Where the grades are flat, the deposits are removed, and where the drain is rapidly deteriorating, repairs are made. By having regular inspections made of these drains, much trouble is obviated. A group of five men with one truck devote all their time to cleaning large storm sewers and reporting their condition.

Maintenance of Sanitary Sewers.—The maintaining of the sanitary sewers usually consists of removing obstructions from the smaller pipes—usually 8 and 10 in. in diameter. On rare occasions a 12 in. sewer will become clogged, and only once or twice during recent years has a 15 in. sewer been obstructed. Where the larger sewers require cleaning, it is usually due to wastes from industries. As is the case with oil, adequate means where possible should be provided to dispose of this waste material other than in the sewers. Much can be done in a cooperative way. For example, Baltimore has a number of factories where tomatoes are canned. Many of these establishments used to dispose of the tomato skins into the sewers until they were notified that this practice was illegal and created considerable trouble at the sewage works.

All obstructions in main line and house sewers up to the building line are removed by the city. On the other hand, chokages in the house sewers inside the property lines are removed by a plumber employed by the property owner. This rule, although a rigid one, is not necessarily adhered to in emergencies. In case the difficulty is due to the carelessness of the property owner he is required to pay for all of the expense involved.

The majority of sewer obstructions are in those sections of the city with a large foreign population. In Roland Park, for instance, the number is relatively small in spite of the fact that many of the sewers are 6 in. in diameter, and are built in curves between man-holes.*

The sanitary sewers of Baltimore are free from objectionable odors. The reason is that sewers have good grades, and are ventilated by the house stacks on each building. Sewers that are free from odors because of good ventilation are good insurance against explosions. Moreover, they can be cleaned without hazard to workmen.

Cleaning Tools.—A wise selection of cleaning tools greatly decreases the cost of maintaining sewers. The first essential is to have good cleaning rods. Two types are used in Baltimore. The rods used to clean out storm drains, are made of wood, 3 ft. long, octagonal in shape, and about 2 in. thick. They have the advantage of being strong, and at the same time sufficiently light to float on the water while they are being shoved through the drain.

The other rods, which are used to clean sanitary sewers, are 4 ft. long with a cross-section of 1⅛ x ⅞ in. Other tools, such as scoops, root cutters, etc., are also of value. One of the greatest time and money saving devices for cleaning sewers has been flexible steel cables. They are narrow but strong ribbons of steel, which are used primarily to clean house sewers. At the end of the cable there are two small steel rollers, which increase the ease with which it can be forced through the sewer. The use of this cable has saved property owners thousands of dollars, which formerly was spent in tearing up and replacing the sewers.

Personnel.—The cleaning of the sanitary sewers and storm drains is under the supervision of one man. As previously stated, there is one gang of 5 men with a truck which spends all of its time in cleaning large storm drains. There are 4 additional gangs with 4 men in each gang—each provided with a truck—which clean inlets, report and replace broken and noisy manhole covers and do other work. Each of these gangs is alloted a section of the city, which it particularly patrols and is responsible for. There is, moreover, a gang of 9 men, which makes repairs both to storm drains and sanitary sewers.

The sanitary sewers are maintained by 9 groups of men. Four of these groups, consisting of 18 men and 2 foremen relieve chokages on main line sewers, while the remaining 5 groups, having a total of 10 men and one foreman relieve house sewer chokages. In addition to the above force there are 2 men who are on duty on Sundays and holidays and also each day from 4 P. M. until midnight. They take care of any emergency that arises after working hours.

Cost of Sewer Maintenance.—The total cost of maintaining 1,560 miles of sanitary sewers and storm drains during 1927 was approximately $158,000. Of this amount $65,000 was spent on 1,000 miles of sewers and house connections at a cost of $65.50 per mile and $92,500 on 560 miles of drains at about $165 a mile.

Acknowledgment.—The foregoing is a paper presented at the 1928 meeting of the Maryland Water and Sewerage Association.

*The Roland Park system was built as a private system prior to Annexation. The city does not construct lateral sewers less than 8 inches in diameter.

New Water Rates at Washington, D. C.

In the fiscal year ended June 30, 1927, the rates for water in the District of Columbia were increased as follows:

The rates for domestic purposes are charged according to stories and front feet. On all tenements two stories high or less with front width of 16 ft. or less, $7.03 per annum, in advance. For each additional front foot or fraction thereof greater than one-half, 44 ct. For each additional story or part thereof, one-third of the charges as computed above.

Business premises are rated according to their size, class, volume of business, and water facilities, and rate from $1.41 to $25. If the flat rate on business establishments reaches $25 or more the owner or occupant is required to install a water meter at his own expense.

A minimum rate of $6.36 is charged against all consumers supplied with water through meters, which allows the use of 7,500 cu. ft. of water during the year; water used in excess is charged for at the rate of 6 ct. per 100 cu. ft. According to the report of J. S. Garland, Superintendent, Water Department, the average payment for metered premises (District meters only) was $7.68. The average payment on flat rate accounts was $9.65.

Build Hospital From Profits of Water Works and Light Plant

Water and Light Board Uses Funds for Work

THE Board of Public Works, of Holland, Mich., of which Roy B. Champion is superintendent, has just completed a very worthy project paid for out of the earnings of the municipally operated water works and electric light plant, the financing being done with idle corporate funds. This unusual venture in public work affords the city a new 50-bed modern hospital without extra cost to the taxpayers after two proposals in recent years to build a municipal hospital were rejected in elections. The project was started in October, 1925, when the Board passed a resolution and transmitted it to the Council, as follows:

"Whereas, the Board of Public Works of the City of Holland has heretofore undertaken, as far as it could consistently do so, with due regard to the business and demands of the Board, to assume and pay the bonded indebtedness, with the interest thereon owing by the City of Holland; and

"Whereas, the Board feels that whenever possible new developments required by the City should be paid for on a current cost basis, rather than the further issuance of City bonds, as far as the same can reasonably be done; and

"Whereas, the Board is of the opinion that a City or Municipal Hospital is urgently needed in the City of Holland, and that it should be built and owned by the City rather than as a separate or private institution; and that if the City as a whole contributes to its construction, the sentimental effect at least will be much greater than if built by private subscription, even though it is later donated to the City; now therefore,

"Be It Resolved, by the Board of Public Works of the City of Holland, that the Board will undertake to finance the erection of a municipal hospital in and for the City of Holland, the details to be later determined upon by a joint committee as the Council may order and appoint, or by a committee agreed upon at a joint meeting of the Board of Public Works, Common Council, and the Hospital Board, said meeting to be called by the Common Council at such time as the Council may order and direct."

The upshot of this resolution was that the council approved the plan, a committee was appointed, and that in due course an architect was appointed, designs were prepared, and finally contracts were let. The architects who designed the hospital were Pond and Pond, Martin and Lloyd of Chicago, a prominent architectural firm whose work is known throughout the country. The building erected, and recently completed, is one of 265,500 cu. ft. capacity,

Exterior and Four Interior Views of the New Municipal Hospital at Holland, Mich., Financed Out of the Profits of the Water Works and Municipal Light Plant

of fireproof construction comprising a combination of reinforced concrete and steel structural frame and floors with brick walls and stone trim and modern interior construction, and is one of a future group of buildings to be developed as rapidly as feasible. One whole floor is devoted to operating and treatment facilities, and part of another, while the remainder of this three story building will be devoted to rooms and wards that will afford a total of 47 beds for patients. The cost of the structure, without equipment, and including architects' fees, was approximately $168,000, while the cost of the land was $7,000 and the cost of improvements to the land was another $8,000. The board did not defray the costs of equipping the building, which costs are necessarily high. The following tabulation gives the construction and other costs assumed by the Department:

General Contract, Extras	$112,880.00
Heating, Ventilating	14,494.50
Plumbing	14,842.58
Water Softener	1,918.00
Electric Wiring	6,773.00
Elevators	5,180.00
Hardware	1,454.00
Weather Stripping, Screens	2,248.00
Architects' Fee	9,084.40
Cost of Building	$168,874.48
Land	7,000.00
Improvements to Land	8,008.48
Grand Total	$183,882.96

Financially, the Board seems well on the way to pay up its indebtedness on this venture without being forced to sell securities now held by the Board that would be available for use in paying for the building. To date the sum of approximately $132,000 is still owed on the work, but due to special arrangements concerning the use of idle City funds and making payments out of the current earnings of the water works and the light plant, it is probable that the full amount will be paid easily without recourse to that sale of the above securities, which are bringing in interest at the rate of 5½ and 6 per cent. This expectation seems reasonable since the pumping stations and light plant are in good shape and no heavy expenditures are to be expected in the near future.

It is interesting to note here that the hospital is showing an operating deficit during first four months of the year of only about $1,500, or an indicated annual deficit of less than $5,000, or about one-half of the amount previously estimated.

It is also of interest to note that in 1927 the lighting plant had a net income of $129,217.14 after deducting operating expenses of $146,258.42 from the total operating revenue of $264,775.14 and adding a non-operating revenue of $10,700.42. This net income covers an output to 4,879 consumers at an average price per kw-hr. of 4.27 ct. and a profit per kw-hr. of 1.91 ct. Out of this profit, the light plant paid out $35,000 on the hospital during 1927.

Records of the water works show that during the same year the total pumpage was approximately 480 MG for the year, and that with a general water rate of 11 ct. per 100 cu. ft. for the first 50,000 cu. ft. and other rates in proportion, and serving an estimated population of 14,500, that the total operating revenue per capita was $4.81, the investment per capita was $28.25, and the net income was $25,685, or $6.27 per $100 invested. The total cost per 1,000 gal. pumped was 9.47 ct., the lowest cost since 1923. The average price received per 1,000 gal. pumped was 14.50 ct.

With such profitable operation of the pumping stations and the electric light plant, it is no wonder that the Board of Public Works has been able to give the taxpayers such a fine new hospital without calling for tax money or selling bonds to pay for the venture.

Cost of Operating the Municipal Asphalt Plant at Washington, D. C.

In the annual report of the operation of the engineering department of the District of Columbia for the fiscal year ended June 30, 1927, Mr. C. B. Hunt, Engineer of Highways, gives the following data on the operation of the municipal asphalt plant.

The total output of the plant for the year was 203,076 cu. ft. of material consisting of 5,568 cu. ft. of old material and 197,508 cu. ft. of topping mixture. The plant was operated for 255¾ days, with an average daily output of 794 cu. ft.

Constant attention is given to the maintenance of the plant, repairs being made and parts replaced when necessary, thereby keeping it in the best operating condition possible. This cost is incorporated in the total cost of output shown below.

The following material in amount and cost average set forth below were purchased for use in manufacturing the output during the year:

Limestone dust, 400 tons	$ 5.45
Sand, 8,020.5 cu. yd. (including haul)	1.32
Asphaltic cement, 1,101.8915 tons	21.65

There were purchased for use in operating the mixer the following large items and the cost average:

Fuel oil, 39,878 gal.	$ 0.06439
Coal, 320.01 tons	5.98
Wood, 50 cords	14.805

The cost of operation, including labor and material, are kept from day to day, and the summary of this data for the fiscal year develops the following unit costs for the year's operation:

Operation of Plant
(Period of operation, 255¾ days; total output, 203,076 cu. ft.)

	Per cu. ft. Cts.
Total manufacturing cost per cubic foot:	
Labor	8.70
Fuel Oil	1.30
Coal	.93
Wood	.18
Total cost	11.11
Haul from plant to street, labor	6.66
On street:	
Labor	30.55
Painting joints	.41
Fuel	.18
Total cost	31.14
Maintenance and repairs:	
At plant	.58
On street	.07
Total cost	.65

Overhead: The original cost was amortized by deducting 20 per cent from same each year during the first five years of its life.

Supervision: Foremen and overseers	5.79
Total manufacturing cost per cubic foot:	
Plant labor	11.11
Hot haul	6.66
Street work	31.14
Maintenance of plant and tools	.65
Supervision	5.79
Total cost	55.35

The sand used was bought under contract at 80 ct. per cubic yard and hauled from the wharf to the plant at the cost of $4,156.14 for 8,020.50 cu. yd., or $0.52 per cubic yard, a total of $1.32 per cubic yard. All other expendable material was delivered at the plant site at the cost thereof used herein.

Topping mixture:	
94.21 lb. of sand, at $0.80 per cu. yd.; hauled, $0.52 per cu. yd.	$0.05483
9.58 lb. limestone dust, at $5.45 per ton	.02610
11.05 lb. asphaltic cement, at $21.65 per ton	.11961
Cost of material	.20054
Manufacturing and placing cost	.55350
Total cost per cu. ft.	.75404

Mr. Hunt has kindly furnished us the following additional information regarding the organization and wages.

The plant operating force consists of one foreman at $7.70 per diem and the following:

1 steam engineer at plant	$ 5.92
1 steam engineer at plant	5.04
1 fireman at plant	*4.00
1 timekeeper	4.48
1 skilled laborer	4.00
12 unskilled laborers	3.68
1 watchman	3.00
5 trucks (owned by District)	†4.00
2 trucks, privately owned, each	10.80

The street placing force is as follows for each repair gang:

1 foreman, per annum	$1,680.00
2 rakers, per diem	4.08
3 tampers, per diem	4.08
3 shovellers, per diem	4.08
4 rollermen, per diem	4.08
4 laborers, per diem	3.08
1 2-ton truck, per diem	10.80
1 1½-ton truck, per diem	**4.00

*Acts as watchman in emergency.
†per diem pay of driver.
**Without driver.

Each gang places an average of about 288 cu. ft. per day. The number of street gangs varies with the seasonal and other controlling conditions up to the total capacity of the plant.

Cost of House Service Sewers at Washington, D. C.—During the fiscal year ended June 30, 1927, service sewers constructed in Washington, D. C. under contract and by day labor totaled 113,131 ft., costing $585,976 and serving 1,153 houses. These figures show the average length of sewers for each house served to be 98.2 ft. at an average cost of $508.66 per house.

Method of Rating Swimming Pools at Baltimore, Md.

Swimming Pool Score Card for Comparing Efficiency

IN the spring of 1926 the Division of Chemical Technology of the Bureau of Chemistry and Food of the City of Baltimore, Md., was instituted to make a survey of all swimming pools in the city and to offer assistance in an effort to correct any faulty and insanitary conditions that might exist. In order to stimulate interest on the part of those in charge of the various pools, a system of competition scoring was inaugurated. This system was described by Mr. M. H. Coblentz, Chief of the Division, in a paper presented at the 1928 meeting of the Maryland Water and Sewerage Association, from which the matter following is taken:

The forms of scoring and rating systems together with an explanation of the items follow:

Expanation of Items on Swmiming Pool Score Cards

The score card and system of rating will be used in rating the sanitary efficiency of your swimming pool. Constant attention to the many details involved in its safe operation will produce higher scores and greater healthfulness. The operator should keep daily records of the number of persons using the pool and other data required for use in scoring. Samples will be drawn from time to time by a Health Department representative for purposes of bacterial and chemical examination.

Equipment.—Walkways surrounding the pool should drain to properly located drains and should be always clean, and scum or overflow gutters shall permit of ready cleaning and flushing.

A plentiful supply of outdoor air and direct sunlight where possible should have access to indoor pools.

Dressing rooms should be well lighted and ventilated as well as commodious and clean. Floors should have good drainage and frequent cleaning. Persons not dressed for bathing should not be allowed on walks surrounding pool.

Before entering the pool all persons shall take a shower bath with soap, and entrance should be direct from the shower. Shower room drains should be adequate for quick removal of waste water. At least 1 shower should be provided for every 40 dressing rooms. Where possible foot pools with running water should precede the shower compartments.

Toilets should be conveniently located and there shall be at least one stool for every 40 rooms. Urinals should be ample and of a type to prevent splashing of urine on the floor, or on to the feet of bathers. Seats should be of sanitary construction and kept clean. The floor shall be of material impervious to water and easily cleaned.

The general layout should be so arranged that the line of travel from natatorium entrance to pool shall be progressive and with no retracing of steps.

Management. — Change of water should be adequate, and the water should be frequently freed from scum. Disinfection whether continuous or between use should be adequate, i.e., there should be an excess of the disinfectant at all times. The representative of the Health Department will be glad to furnish chlorine testing equipment and advice concerning control of disinfection, etc.

All bathing suits and towels should be steam washed with soap after each use. If chemically disinfected this should follow the steam washing and precede rinsing. Only non-colored or fast-color suits should be used. No common combs or brushes should be accessible in dressing rooms or pool areaways.

To prevent spread of communicable diseases, no persons with eruptions or bandages, nor persons suffering from fever cold, cough or inflamed eyes should be allowed to use the pool, and spitting in, or in any other way contaminating the pool, floors, runways, aisles or dressing rooms should be prohibited.

Bather control should be rigidly enforced. Every person should bathe

Name ..... Supt. .....
No. of bathers last week..... No. of gallons water added last week.....
Date of last emptying and scoring.....
Disinfectants used..... Date of last check up.....

Equipment	Score
POOL STRUCTURE—20	
Walls, waterproof and smooth	4
Floors, waterproof and smooth	4
Curbing, 2 in. high	4
Curbing, 1 in. high	2
Walkways, sanitary, cleanable	4
Scum gutters	4
VENTILATION—10	10
LIGHT—15	
Direct sunlight from all sides	15
DRESSING ROOMS—5	
Light and ventilation	2
Cleanableness	2
Restriction to bathers	1
SHOWERS AND BATHS—30	
Automatic shower	10
Automatic foot-bath	10
Soap	10
TOILETS—15	
Adequacy (1 to 40 rooms)	3
Sanitation (absence of splash on feet)	4
Flushing (automatic or continuous)	2
Seats (sanitary construction)	6
LAYOUT—5	5
	100

Management	Score
WATER—35	
Changed weekly	10
Freedom from scum	5
Disinfection, continuous	10
Between use	10
LAUNDERING—6	
Towels suits, etc. soap washed	3
Disinfected	3
COMMUNICABLE DISEASE PRECAUTIONS—15	
(Persons with eruptions, bandages, etc.	15
BATHER CONTROL—20	
Bathing before entering	10
Limitation to 1 hr.	5
Limitation to 20 persons per 1,000 gals. of entering water during period	5
POSTERS—4	
Cards about pool at least, 10x12	2
Cards in dressing rooms	1
Notices prominently displayed	1
RECORDS—20	
Number of bathers	4
Vol. new water added	4
Temp. of water	1
Temp. of air	1
Water treatment data	5
Cleaning data	3
Chemical data	2
	100

SYSTEM OF RATING

	Score
Equipment (score)	100
Management (score x2)	200
Condition of water (data of Health Department)	200
Bacterial control—100	
Counts	50
Not over 10 per cent of samples over 2000 per c.c. at 20 deg.	25
Not over 10 per cent of samples over 500 c.c. per c.c. at 37 deg.	25
Index—50	
Not over 2 out of 5 samples positive for confirmed B. coli on same day	25
Not over 3 out of 10 samples positive for confirmed B. coli on consecutive days	25
Chemical control—100	
Chlorine—90	
Over 0.2 p.p.m.	90
0.15—0.2 p.p.m.	80
0.1—0.15 p.p.m.	50
0.05—0.1 p.p.m.	20
Acidity—10	
Alkaline reaction	10
Neutral	5
Acid	0
Score	500
Rating (Score divided by 5)	100

with soap before being allowed to enter the pool. No person should stay in the pool more than 1 hour.

A limit of 20 persons per 1,000 gal. of entering water during any period will be considered a proper bathing load. Entering water shall mean new clean water used to replace loss by splashing or during cleaning, and water taken from the pool and returned after effective filtration, or any combination of such water.

Notices and posters should be at least 10 in. x 12 in. and should be placed in conspicuous places throughout the natatorium.

Accurate records should be kept of the number of bathers per day, volume of new water added, and the temperature of water and air. Water treatment and cleaning data should be recorded regularly, and where chlorine, hypochlorite or other chlorine compounds are used, records of frequent tests by the operator should be kept. Excess chlorine should not be less than 0.2 nor more than 0.5 p.p.m.

The temperature of the water of artificially heated pools should not be above 72 deg. F nor under 60 deg. F. and the air temperature should be about 5 deg. F. warmer than the pool temperature, but not over 8 deg. F. warmer nor 2 deg. F. colder than the pool water. Where alum or sulphate of aluminum is used or where artificial alkalinity is added to the water, tests for acidity and alkalinity should be made every day that the pool is used.

Cost of Feeding Street Department Horses at Toronto, Ont.

The Street Cleaning Department of Toronto, Ont., maintains 384 horses. The average cost per day per horse for fodder in 1927 was 54.8 ct., according to the annual report of George W. Dies, Street Commissioner of Toronto.

The average daily rations per horse, based upon the consumption during the year, amounted to 13.2 lb. of oats, 35 lb. of hay, and 4 lb. of bran, while in addition 0.1 lb. of other feed was given, consisting principally of salt, vegetables, etc. Each horse was also bedded with 4 lb. of straw daily, while the specific rational allotment is 15 lb. of oats, and 25 lb. of hay per horse per day. This amount in many cases varied according to the temperament of the horse. On Sundays and holidays, or in the event of horses standing in the stable, only light feeding of oats is given.

The purchase of fodder supplies is an important item. Every care is exercised to ascertain that all feed is of governmental standard and free from moisture, dust, or rust.

The following is the detailed cost of fodder consumption per horse per day in 1927:

				Cost per Horse per day
Oats	13.2 lb.	at $ 0.632	per bu.	$0.246
Hay	35.9 lb.	at 14.95	per ton	0.268
Straw	4.7 lb.	at 10.96	per ton	0.026
Bran	.4 lb.	at 34.18	per ton	0.009
Salt	.05 lb.	at 22.50	per ton	
Carrots	.05 lb.	at 12.00	per ton	
Daily average, horses				380
Total horse days				138,871
Cost per horse per day				$0.548

Chart for Determining Chlorine Dose

A nomograph for determining the chlorine dose applied to a liquid that offers a rapid and accurate means of making such determination by a very simple operation is shown in the April Bulletin of the Maryland State Department of Health. Its utility may best be indicated by reviewing the example shown:

1,000,000 gal. of liquid treated with 8.33 lb. of chlorine; the resulting dose is read on the middle scale as 1 p.p.m. (if using liquid chlorine) and ⅓ p.p.m. (if using commercial hypochlorite of lime).

The chart was prepared primarily for use by the engineers of the Bureau of Sanitary Engineering of the Maryland State Department of Health for making determinations in the office and field. Later, it was decided to distribute copies to plant operators throughout the state so that they would have a time-saving, simple and accurate means of checking the operation of their plants.

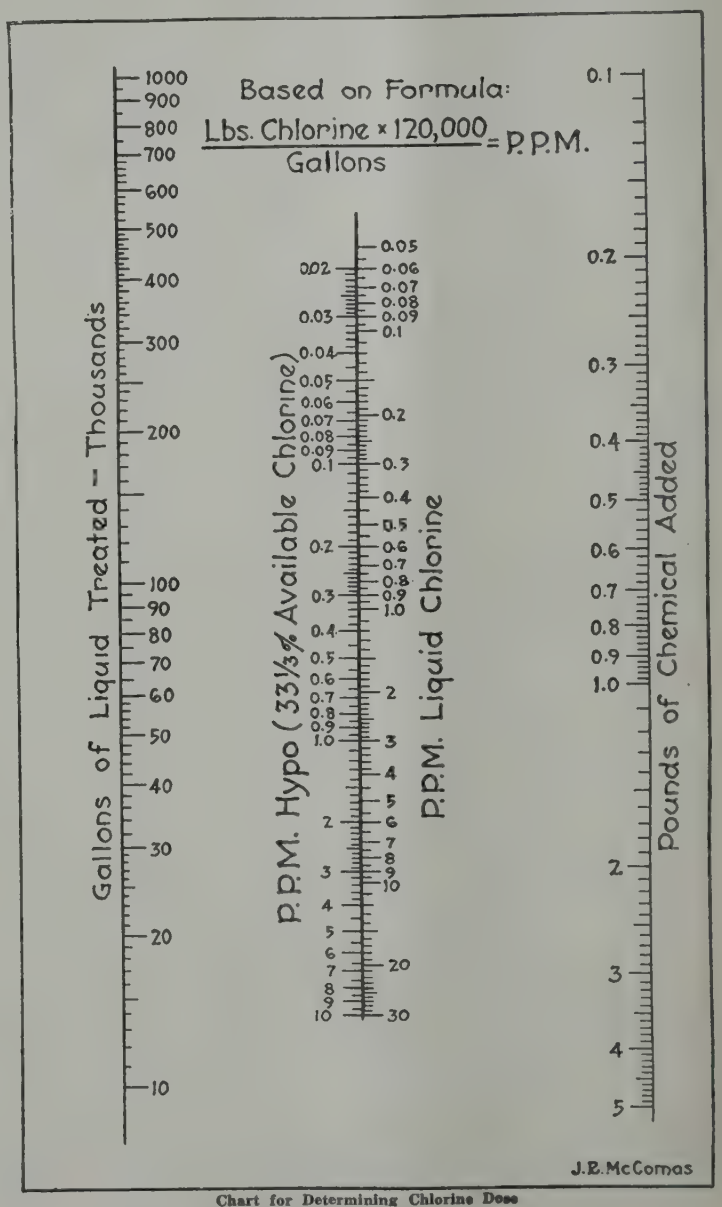


Chart for Determining Chlorine Dose

Tentative Draft of a Model Municipal Traffic Ordinance

Report of Hoover Committee Made Public on May 1

IN response to requests from a number of the organizations participating in the National Conference on Street and Highway Safety that a model municipal traffic ordinance be drawn up, Secretary of Commerce Hoover in the summer of 1927 appointed a committee to report on the subject.

The committee carried on preliminary work during the summer and fall, including an analysis of the traffic ordinance of 100 American cities together with the model ordinances existing in several states and a study of the subject matter appropriate for an ordinance adaptable to the needs of municipalities throughout the country. At a meeting in Washington, Dec. 7-10th the committee developed this material into a preliminary draft. This was further revised by the committee and put into tentative form for distribution to all interested for criticism and comment. This tentative draft of the model municipal traffic ordinance was given out on May 1. We are reprinting it below:

MODEL MUNICIPAL TRAFFIC ORDINANCE

An ordinance regulating traffic upon the public streets of the (City) or ( ) and repealing Ordinance (No.) and all other ordinances and sections of Ordinances in conflict herewith.

It is ordained by ( ) as follows:

ARTICLE I
DEFINITIONS

Section 1

Whenever in this Ordinance the following terms are used, they shall have the meanings respectively ascribed to them in this section.

Street or Highway. Every way set apart for public travel, except foot paths.

Private Road or Driveway. Every road or driveway not open to the use of the public for purposes of vehicular travel.

Roadway. That portion of a street or highway between the regularly established curb lines or that part devoted to vehicular traffic.

Sidewalk. That portion of a street between the curb lines and the adjacent property lines.

Intersection. The area embraced within the prolongation of the lateral curb lines or, if none, then the lateral boundary lines of two or more streets or highways which join one another at an angle whether or not one such street or highway crosses the other.

Crosswalk. That portion of a roadway ordinarily included within the prolongation of curb and property lines at intersections, or any other portion of a roadway clearly indicated for pedestrian crossing by lines or other markings on the surface.

Safety Zone. The area or space officially set apart within a roadway for the exclusive use of pedestrians and which is so marked or indicated by proper signs as to be plainly visible at all times while set apart as a safety zone.

Vehicle. Every device in, upon or by which any person or property is or may be transported or drawn upon a public highway, excepting devices moved by human power or used exclusively upon stationary rails or tracks.

Motor Vehicle. Every vehicle, as herein defined, which is self propelled.

Street Car. Every device traveling exclusively upon rails when upon or crossing a street, other than cars or trains propelled or moved by steam.

Authorized Emergency Vehicle. Vehicles of the Fire Department, (Fire Patrol), police vehicles and such ambulances and emergency vehicles of municipal departments or public service corporations as are designated or authorized by the (Chief of Police).

Pedestrian. Any person afoot.

Operator. Any person who is in actual physical control of a vehicle.

Traffic. Pedestrians, ridden animals, herded animals, vehicles and street cars either singly or together while using any street for purposes of travel.

Right-of-Way. The privilege of the immediate use of the street or highway.

Parking. The stopping or standing of a vehicle, whether attended or unattended, upon a roadway, otherwise than temporarily for the purpose of and while actually engaged in loading or unloading, or in obedience to traffic regulations or traffic signs or signals.

Official Traffic Signs. All signs and markings, other than signals, not inconsistent with this Ordinance, placed or erected by authority of a public body or official having jurisdiction, for the purpose of guiding, directing, warning or regulating traffic.

Official Traffic Signals. All signals, not inconsistent with this Ordinance, placed or erected by authority of a public body or official having jurisdiction, for the purpose of directing, warning or regulating traffic.

Traffic Control Signal. Any device using colored lights, or words, or any combination thereof, whether manually, electrically or mechanically operated, by which traffic is alternately directed to stop and to proceed.

Business District. The territory contiguous to and inclusive of a street or highway when 50 per cent or more of the frontage thereon for a distance of 300 ft. or more is occupied by buildings in use for business or industry.

Residence District. The territory contiguous to and inclusive of a street or highway not comprising a business district, when the lots with a frontage on such street or highway for a distance of 300 feet or more are mainly occupied by dwellings or by dwellings and buildings in use for business.

Police Officer. Every officer of the Municipal Police Department or any officer authorized to direct or regulate traffic or to make arrests for violations of traffic regulations.

Notes to Article 1—Definitions. The term **street or highway** is defined in as few words as possible and to embrace every street area in its entirety, including sidewalks. Requirements of law in some states may necessitate a further elaboration with specific reference to particular types of public ways, such as bridges, viaducts, vehicular tunnels, boulevards, avenues and other descriptive terms. However, in most states such enumeration is unnecessary, as all the various types of roads are held to be covered by the phrase, "Every way set apart for public travel."

ARTICLE II
AUTHORITY OF POLICE

Section 2. **Police to Direct Traffic.**

It shall be the duty of the Police Department of this city to enforce the provisions of this Ordinance. Officers of the Police Department are hereby authorized to direct all traffic either in person or by means of visible or audible signal in conformance with the provisions of this Ordinance, provided that in the event of a fire or other emergency or to expedite traffic or safeguard pedestrians, officers of the Police or Fire Department may direct traffic, as conditions may require, notwithstanding the provisions of this Ordinance.

Section 3. **(Board of Police Commissioners) Authorized to Adopt Emergency Regulations.** The (Board of Police Commissioners) is hereby empowered to make and enforce regulations necessary to make effective the provisions of this Ordinance and to make temporary regulations to cover emergencies or special conditions, provided any such regulations are not inconsistent with the provisions of this Ordinance.

Note to Section 3. If desired a provision might be included in this section authorizing the police commission or other proper board or body to make and enforce additional regulations.

Section 4. **Obedience to Police.**

It shall be unlawful for any person to refuse to fail to comply with any lawful order, signal or direction of a police officer.

Section 5. **Public Employees to Obey Traffic Regulations.**

(a) The provisions of this Ordinance shall apply to the operator of any vehicle owned by or used in the service of the U. S. Government, this State, County or (City) and it shall be unlawful for any said operator to violate any of the provisions of this Ordinance, except as otherwise permitted in this ordinance.

(b) The provisions of this Ordinance regulating the movement, parking and standing of vehicles shall not apply to authorized emergency vehicles as defined in this Ordinance while the driver of such vehicle is operating the same in an emergency in the necessary performance of public duties. This exemption shall not, however, protect the driver of any such vehicle from the consequence of a reckless disregard of the safety of others.

Section 6. **Persons Propelling Push Carts or Riding Bicycles or Animals to Obey Traffic Regulations.**

Every person propelling any push cart or riding a bicycle or an animal upon a roadway, and every person driving any animal, shall be subject to the provisions of this ordinance applicable to the operator of any vehicle, except those provisions of this Ordinance with reference to the equipment of vehicles and except those provisions which by their very nature can have no application.

ARTICLE III
TRAFFIC SIGNS AND SIGNALS

Section 7. **Traffic Signs and Signals.**

(a) The (municipal legislative body) shall by resolution determine and designate the character or type of all official traffic signs and signals.

Subject to this selection, the (traffic authority) is hereby authorized, and as to those signs and signals required hereunder, it shall be the duty, to place and maintain or cause to be placed and maintained all official traffic signs and signals. All signs and signals required hereunder for a particular purpose shall so far as practicable be uniform throughout the (City).

(b) No provision of this Ordinance for which signs are required shall be enforceable against an alleged violator, if, at the time and place of the alleged violation the sign herein required is not in proper position and sufficiently legible to be seen by an ordinarily observant person.

Note to Section 7. In this and subsequent sections the term (traffic authority) is used merely as indicating that a city upon adopting the Ordinance should insert the designation of the appropriate city officer, board or department such as the chief of police, traffic engineer, superintendent of streets, etc., whose duty it shall be to carry out the provisions of the particular section. Also, in view of the fact that certain states apply a more strict rule than others with reference to the delegation of powers to administrative officers or boards, it may be necessary in certain instances to insert in place of (traffic authority) the correct designation of the legislative body of the city.

Section 8. **Obedience to Traffic Signs and Signals.**

It shall be unlawful for any operator or for the motorman of any street car to disobey the instructions of any official traffic sign or signal upon the street placed in accordance with the provisions of this Ordinance, unless otherwise directed by a police officer.

Section 9. **Traffic Control Signal Legend.**

Whenever traffic at an intersection is alternately directed to stop and to proceed by the use of signals exhibiting the words "Stop," "Go" or "Caution" (or "Wait") or exhibiting colored lights, said terms and lights shall indicate as follows and no colored lights other than those specified herein shall be used.

(a) When the word "Stop" or the color red is exhibited after green, no waiting vehicle facing the signal shall proceed until the green or "Go" signal is displayed alone, and every moving vehicle facing the signal shall stop on the near side of the crosswalk (or the nearest property line of the cross street), unless at the time the word "Stop" or the color red is first displayed the moving vehicle is less than the normal braking distance from the crosswalk (or nearest property line of the cross street), in which event it may proceed. When the word "Stop" or the color red is exhibited after yellow or amber, no vehicle facing the signal shall enter the intersection until the green or "Go" signal is displayed alone.

(b) When the word "Go" or the color green is exhibited alone, traffic facing the signal may proceed, except that such traffic shall yield the right of way to pedestrians and vehicles lawfully within a crosswalk or the intersection at the time such signal was exhibited.

(c) When the word "Caution" or "Wait" or the color yellow or amber is exhibited following or with green, no waiting vehicle facing the signal shall proceed, and every moving vehicle facing the signal shall stop if possible as provided in subsection (a) of this section. When such word or color is exhibited following or with red, no vehicle facing the signal shall enter the intersection until the green or "Go" signal is displayed alone.

Note to Section 9. In the event of special conditions rendering it advisable to permit right or left turns by traffic facing a red or "Stop" signal, it is suggested that an additional subsection be added to Section 9 to read as follows:

(d) A special signal light in the form of an arrow showing green may be employed to permit turning movement in the direction of the arrow at times when such movement would otherwise be prohibited according to the traffic control signal legend set forth in this section.

Section 10. **Display of Unauthorized Signs and Signals Prohibited.**

It shall be unlawful for any person to place or maintain or to display upon or in view of any street any unofficial sign, signal or device which purports to be or is an imitation of or resembles an official traffic sign or signal, or which attempts to direct the movement of traffic. Every such prohibited sign, signal or device is hereby declared to be a public nuisance, and the (Chief of Police) is hereby empowered to remove the same, or cause it to be removed, without notice.

Section 11. **Interference with Signs and Signals Prohibited.**

It shall be unlawful for any person to wilfully deface, injure, move, obstruct or interfere with any official traffic sign or signal.

Section 12. **(Traffic Authority) Authorized to Designate Crosswalks.**

The (traffic authority) is hereby authorized to establish and to designate and shall thereafter maintain, by appropriate devices, marks or lines upon the surface of the roadway, crosswalks approximately equal in width to the adjacent sidewalk at all intersections where in his opinion there is particular danger to pedestrians crossing the roadway.

Section 13. **(Traffic Authority) Authorized to Designate Safety Zones and Lanes for Traffic.**

(a) The (traffic authority) is hereby empowered to establish safety zones of such kind and character and at such places as he may deem necessary for the protection of pedestrians.

(b) The (traffic authority) is also authorized to mark lanes for traffic on street pavements at such places as he may deem advisable, consistent with the provisions of this Ordinance.

Note to Sections 12 and 13. If it is desired that the designated officer shall also determine and designate those intersections at which left turns shall not be made an additional subdivision might be added to Section 12 to read as follows:

(c) The (traffic authority) is hereby empowered to determine those intersections at which operators of vehicles shall not make a left turn and shall place proper signs at such intersections.

If the Ordinance itself is to designate the intersections at which no left turns shall be made then an additional section should be inserted following Section 38, to read as follows:

Section 38½. Left Turns Prohibited. The operator of a vehicle shall not (between the hours of 7 A. M. and 7 P. M. of any day except Sunday or a legal holiday) make a left turn at any of the following intersections:.....

.....

.....

Signs shall be erected and maintained designating the provisions of this section.

Additional Note: In special cases where pedestrian movement is very heavy or other conditions require it, it may be advisable to eliminate right turns or all turns. This can be treated by the same alternative methods suggested above.

ARTICLE IV
PEDESTRIANS' RIGHTS AND DUTIES

Section 14. **Pedestrians' Right of Way.**

(a) The operator of any vehicle shall yield the right of way to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at the end of a block, except at intersections where the movement of traffic is being regulated by police officers or traffic control signals.

(b) When a pedestrian crossing or about to cross a roadway and having the right of way as above provided indicates his intention to proceed by holding up his hand palm out toward approaching traffic, no operator of a vehicle more than the normal braking distance from such pedestrian shall fail to grant the right of way to said pedestrian; provided, however, that failure of a pedestrian so to hold up his hand shall in no way relieve the driver of a vehicle from the provisions of paragraph (a) above.

(c) Whenever any vehicle has stopped at a marked crosswalk or at any intersection to permit a pedestrian to cross the roadway, it shall be unlawful for the operator of any other vehicle approaching from the rear to overtake and pass such stopped vehicle.

(d) Every pedestrian crossing a roadway at any point other than within a marked or unmarked crosswalk shall yield the right of way to vehicles upon the roadway, provided that this provision shall not relieve the driver of a vehicle from the duty to exercise due care for the safety of pedestrians.

Section 15. **Pedestrians' Rights and Duties at Controlled Intersections.**

At intersections where traffic is controlled by traffic control signals or by police officers, pedestrians shall yield the right of way to vehicles lawfully proceeding directly ahead on a "Go" signal as authorized in Section 9, and operators of vehicles shall yield the right of way to pedestrians crossing or those who have started to cross the roadway on a "Go" signal.

Note to Section 15. In those municipalities where it is believed that pedestrian obedience to traffic control signals should be definitely required, the following wording for Section 15 is suggested:

Alternate Section 15. Pedestrians' Rights and Duties at Controlled Intersections.

On streets where traffic at intersections is controlled by traffic control signals or by police officers pedestrians shall not cross a roadway against a red or "Stop" signal, and shall not cross at any place except in a marked or unmarked crosswalk. A pedestrian crossing or starting across in any such crosswalk on a green or "Go" signal shall have the right of way over all vehicles, including those making turns, until such pedestrian has reached the opposite curb or a safety zone, and it shall be unlawful for the operator of any vehicle to fail to yield the right of way to any such pedestrian.

Note—The success of a rule requiring definite obedience to traffic control signals by pedestrians depends in large measure upon a proper timing of the signals, and also intensive educational activities. This point is discussed in the report accompanying this model ordinance.

Section 16. **Pedestrians to Use Right Half of Crosswalk.**

Pedestrians shall move, whenever practicable, upon the right half of crosswalks.

Section 17. **Pedestrians Soliciting Rides.**

It shall be unlawful for any person to stand in a roadway for the purpose of soliciting a ride from the operator of any private vehicle.

ARTICLE V
STREET CARS AND RAILROAD TRAINS

Section 18. **Pasing Street Cars.**

(a) The driver of a vehicle shall not overtake and pass upon the left any interurban or street car proceeding in the same direction, whether actually in motion or temporarily at rest, when a travelable portion of the highway exists to the right of such street car.

(b) The driver of a vehicle overtaking any railway, interurban or street car stopped or about to stop for the purpose of receiving or discharging any passenger, shall bring such vehicle to a full stop at least 10 ft. in the rear of such street car and remain stationary until any such passenger has boarded such car or reached the adjacent sidewalk, except that where a safety zone has been established, or at an intersection where traffic is controlled by an officer or traffic stop-and-go signal, a vehicle need not be brought to a full stop before passing any such railway, interurban or street car, but may proceed past such car at a speed not greater than is reasonable or proper and in no event greater than 10 miles an hour and with due caution for the safety of pedestrians.

Note to Section 18. The text appearing above is taken verbatim from the Uniform Vehicle Code approved by the National Conference on Street and Highway Safety. The Committee on Municipal Traffic Ordinances and Regulations recommends that the Uniform Vehicle Code be amended to incorporate, and that the Model Municipal Traffic Ordinance incorporate, a revised section on passing street cars to read as follows:

Revised Section 18. **Passing Street Cars.**

(a) The operator of a vehicle shall not overtake and pass upon the left any street car proceeding in the same direction, whether actually in motion or temporarily at rest, when a traversable portion of the highway exists to the right of such street car, even though such portion of the highway is occupied by traffic. This provision shall not apply on one-way streets.

(b) The operator of a vehicle overtaking any street car stopped or about to stop for the purpose of receiving or discharging any passenger, shall stop such vehicle to the rear of the nearest running board or door of such street car and keep it stationary until any such passenger has boarded such car or reached a place of safety, except that where a safety zone has been established, a vehicle need not be stopped before passing any such street car, but may proceed past such car at a speed not greater than is reasonable or proper, and with due caution for the safety of pedestrians.

Note to Revised Section 18. In streets where the street car track or tracks are located elsewhere than in or near the center of the roadway, or where because of unbalanced vehicle traffic or for any other reason it becomes desirable to establish lanes of traffic on the left of street cars, an exception to paragraph (a) above can be made. Such streets will probably not be numerous and the permanent location of the car tracks will definitely govern the conditions, so that they can be named in a new paragraph (b). which will also embody the last sentence of paragraph (a), as follows:

(b) The provision in subsection (a) shall not apply on one-way streets, or on the following streets between the points named:

.....

.....

Section 19. **Driving on Street Car Tracks.**

(a) It shall be unlawful for the operator of any vehicle proceeding upon any street car tracks in front of a street car upon a public street, to fail to remove such vehicle from the tracks as soon as practicable after signal from the operator of said street car.

(b) When a street car has started to cross an intersection, no operator shall drive upon the car tracks within the intersection in front of the street car.

Section 20. **Driving Through Safety Zone Prohibited.**

It shall be unlawful for the operator of a vehicle at any time to drive the same over or

through a safety zone as defined in this ordinance.

Note to Section 20. In the event a municipality desires to prohibit driving to the left of a safety zone, a provision as follows should be added to Section 20:

(b) It shall be unlawful for the operator of a vehicle at any time to drive the same to the left of a safety zone.

Section 21. **Boarding or Alighting from Street Cars or Vehicles.**

It shall be unlawful for any person to board or alight from any street car or vehicle while such street car or vehicle is in motion.

Section 22. **Unlawful Riding.**

It shall be unlawful for any person to ride on any street car or vehicle upon any portion thereof not designed or intended for the use of passengers when the vehicle is in motion. This provision shall not apply to an employee engaged in the necessary discharge of a duty, or within truck bodies in space intended for merchandise.

Section 23. **Railway Trains and Street Cars Not to Block Street.**

It shall be unlawful for the directing officer or the operator of any steam or street railway train or car to direct the operation of or to operate the same in such a manner as to prevent the use of any street for purposes of travel for a period of time longer than five minutes, except that this provision shall not apply to trains or cars in continuous motion. It shall be unlawful for any street railway train or car to stop within an intersection or on a crosswalk for the purpose of receiving or discharging passengers.

ARTICLE VI
STOPPING, STANDING AND PARKING

Section 24. **Stopping Prohibited in Specified Places.**

It shall be unlawful for the operator of a vehicle to stop, stand or park such vehicle in any of the following places, except when necessary to avoid conflict with other traffic or in compliance with the directions of a police officer or traffic control sign or signal:

(1) Within an intersection.

(2) On a crosswalk.

(3) Between a safety zone and the adjacent curb or within twenty (20) ft. of a point on the curb immediately opposite the end of a safety zone, unless the (traffic authority) shall indicate a different length by signs.

Note: It is recommended that in no event should vehicles be stopped or parked within fifteen (15) ft. of the end of a safety zone. The exact distance to be specified might depend upon the width of the roadway, volume of traffic and other material factors.

(4) Upon the approach to an intersection, within fifteen (15) ft. of the inside boundary line of the sidewalk, or, if no sidewalk is in place, within twenty-five (25) feet of the intersecting roadway, except that this provision shall not apply at alleys.

(5) Within fifteen (15) ft. of the driveway entrance to any fire station, or directly across the street from such entrance.

(6) Within fifteen (15) ft. of a fire hydrant.

(7) In front of a private driveway.

(8) On a sidewalk.

(9) Alongside or opposite any street excavation or obstruction when such stopping, standing or parking would obstruct traffic.

Note to Section 24. This Section and Section 33 are designed to prohibit double line stopping or parking and specifically prohibit stops even temporarily for any purpose in those places enumerated in Section 24 except as noted therein.

It has been pointed out that such regulations, coupled with the fact that remaining curb space may be fully occupied by parked vehicles, would render it impossible for a bus, taxicab or private vehicle to pull alongside the curb or to stop even temporarily in the second line of traffic or in any of the prohibited spaces to load or unload passengers. In other words, there might be no place legally available for a temporary stop.

While stopping even temporarily in most of the places enumerated causes interference with moving traffic and may well be prohibited as declared in the text, and while ample passenger zones, as distinguished from loading zones, designated as provided in Section 25 to permit buses, taxicabs and private vehicles to load and unload passengers at the curb, may meet the situation, an additional method has been suggested that Subdivisions (6) and (7) be omitted from Section 24 and placed in a separate section providing that stopping or parking in such places shall be prohibited, except temporarily for the purpose of, and while actually engaged in, loading or unloading passengers. Such a section might read as follows:

Section 24½. **Stopping Temporarily to Load or Unload Passengers.**

It shall be unlawful for the operator of a vehicle to stop or park such vehicle in any of the following places except temporarily for the purpose of and while actually engaged in loading or unloading passengers, and in no case shall such vehicle be left even momentarily unattended:

(1) Within fifteen (15) ft. of a fire hydrant.

(2) In front of a private driveway.

Section 25. **Standing for Loading or Unloading Only in Certain Places.**

(a) It shall be unlawful for the operator of a vehicle to stop, stand or park said vehicle for a period of time longer than is necessary for the actual loading or unloading of passengers in any place marked as a passenger zone.

(Note to subsection (a).) Passenger zones are required for the convenience of passenger traffic at places of public gatherings such as the entrances to schools, churches, theatres, hotels, hospitals and so forth. They should be clearly marked as to their extent and the hours when the regulation is applicable, and during those hours should be used exclusively for passenger loading and unloading.

(b) It shall be unlawful for the operator of a vehicle to stop, stand, or park said vehicle for a period of time longer than is necessary for the actual loading or unloading of passengers, or for the unloading and delivery or pick up and loading of materials, in any place marked as a loading zone.

(Note to subsection (b.) Loading zones are requisite to reduce double-line parking in congested districts, through the provision of suitable spaces along the curbs for loading and unloading operations. Loading zones should be placed as required before the shipping entrances to buildings, and at other places where there is a large volume of commercial traffic. Where necessary the regulation should be applied to the lengths of alleys or other ways where the parking interferes with the loading and unloading of mechandise. Since passenger loading or unloading is of short duration it may be permitted in such zones without undue interference to commercial traffic.

It may be desirable to permit unrestricted parking in loading zones during evening hours, in which event there should be added to paragraph (b) the sentence: "The provisions of this subsection (b) shall not be applicable between the hours of 6:00 P. M. and 6:00 A. M."

(c) The (traffic authority) shall have authority to determine the location of passenger zones and loading zones as described herein, and shall erect and maintain appropriate signs indicating the same.

Note to subsection (c). A municipality may desire to specify more definitely in subsection (c) the limitations to govern the (traffic authority) in locating passenger zones and loading zones. In some ordinances it is provided that loading zones shall not exceed a stated percentage of the curb lines in any block.

Section 26. **(Traffic Authority) Authorized to Designate Bus Stop, Taxicab Stands and Hackney Stands.**

The (traffic authority) is hereby authorized and required to establish bus stops, taxicab stands and hackney stands on public streets in such places and in such number as he shall determine to be of the greatest benefit and convenience to the public, and shall appropriately sign every such bus stop, taxicab stand or hackney stand.

Note to Section 26. A municipality may desire to specify in more or less detail in the ordinance the places where the bus stops, taxicab stands, and hackney stands may be located by the (traffic authority).

Section 27. **Other Vehicles Prohibited from Parking in Bus Stops, Taxicab Stands or Hackney Stands.**

It shall be unlawful for the operator of any vehicle other than a bus to stand or park in an officially designated bus stop, or for any vehicle other than a taxicab to stand or park in an officially designated taxicab stand, or for any vehicle other than a hackney to stand or park in an officially designated hackney stand, except that the operator of any passenger vehicle may temporarily stop in any such stop or stand for the purpose of and while actually engaged in the loading or unloading of passengers.

Section 28. **Buses, Taxicabs and Hackneys Prohibited from Parking Except in Designated Stands.**

It shall be unlawful for the operator of any bus, taxicab or hackney to stand or park upon any street in any business district at any place other than at a bus stop, taxicab stand or hackney stand respectively, except that this provision shall not prevent the operator of any such vehicle from temporarily stopping in accordance with other parking regulations at any place for the purpose of and while actually engaged in loading or unloading passengers.

Note to Sections 26, 27 and 28. The designations of bus stops is for the primary purpose of providing spaces where buses can receive and discharge passengers without impeding traffic. The designation of taxicab stands and hackney stands serves the same purpose with respect to taxicabs and hackneys and the additional important purpose of removing the incentive to cruising. A municipality may not desire, however, to differentiate between bus stops, taxicab and hackney stands, in which event Sections 26, 27 and 28 can be simplified to provide for the designation of stands for public vehicles, to prohibit other than public vehicles from parking in those stands, and to prohibit public vehicles from parking elsewhere.

Section 29. **Parking Prohibited in Certain Places.**

It shall be unlawful for any operator to stop, stand or park any vehicle in such a manner or under such conditions as to leave available less than 10 ft. of the width of the roadway for the free movement of vehicular traffic, except that this provision shall not apply to the operator of a vehicle stopped momentarily during the actual loading or unloading of passengers if such stopping does not actually impede traffic, nor shall it apply to a necessary stop in obedience to traffic regulations or traffic signs or signals or a police officer.

Section 30. **Parking Time Limited in Designated Places.**

The operator of a vehicle shall not park such vehicle for longer than.....at any time, between the hours of.....A. M. and.....P. M. of any day except Sundays and public holidays in the following described district:

.....

.....

Signs shall be erected and maintained in each block designating the provisions of this section.

Note to Section 30. This section is appropriate where it is desired to limit parking in any designated district to a certain maximum length of time between specified hours.

Section 31. **Parking Prohibited During Certain Hours in Designated Places.**

The operator of a vehicle shall not park such vehicle between the hours of.....of any day except Sundays and public holidays within the (designated district) or upon any of the following described streets:

.....

.....

Signs shall be erected and maintained in each block designating the provisions of this section.

Note to Section 31. This section is appropriate where it is desired to prohibit parking in the central business district or on certain streets during the entire business day or during the morning or evening rush hours, or at other times to be specified in the section.

Section 32. **Early Morning Parking Limited.**

It shall be unlawful for the operator of any vehicle to park said vehicle on any street for a period of time longer than thirty (30) minutes between the hours of (2) A. M. and (6) A. M. of any day.

Note to Section 32. This section is appropriate where it is desired to prohibit all-night parking.

Section 33. **Standing or Parking Close to Curb.**

(a) Except when necessary in obedience to traffic regulations or traffic signs or signals, the operator of a vehicle shall not stop, stand or park such vehicle in a roadway other than parallel with the edge of the roadway, headed in the direction of traffic, and with the curbside wheels of the vehicle within 1 ft. of the edge of the roadway, except as provided in the following three paragraphs:

(1) Upon those streets which have been marked or signed for angle parking, vehicles shall be parked at the angle to the curb indicated by such marks or signs.

(2) In places where, and at hours when,

stopping for the loading or unloading of merchandise or materials is permitted, vehicles used for the transportation of merchandise or materials may back into the curb to take on or discharge loads, when the owner of such vehicle holds a permit granting him such special privilege, and provided further that such permit shall be either in the possession of the operator or on the vehicle at the time such vehicle is backed against the curb to take on or discharge a load, and it shall be unlawful for any owner or operator to violate any of the special terms or conditions of any such special permit.

(3) On a street where there is a perceptible grade a vehicle when stopped or left unattended shall have a front wheel or a rear wheel turned at an angle against the curb.

(b) The (traffic authority) shall determine upon what streets angle parking shall be permitted and shall mark or sign such streets or cause the same to be marked or signed.

(c) The (traffic authority) is hereby authorized to issue, to any owner of a vehicle used to transport merchandise or materials, a special permit, renewable annually, and to state therein the terms and conditions thereof, allowing the operator of such vehicle the privilege of loading and unloading while the vehicle is backed against the curb, if in the opinion of the (traffic authority) such privilege is reasonably necessary in the conduct of the owner's business and will not seriously interfere with traffic.

Note to Section 33, Paragraph (a) (2) and (c). These provisions are designed to permit, under the conditions stated, the backing of a vehicle to the curb for purposes of loading or unloading. While this practice should be discouraged as a serious interference with other vehicular movement on roadways, it is realized that it is difficult to load or unload certain present equipment from the side. Trucks can now be equipped at low cost, however, so that they can be elevated to unload such material as coal from either side or from the rear.

ARTICLE VII
OPERATION OF VEHICLES

Section 34. **Drive on Right Side of Street.**

Upon all streets, except upon one-way streets, the operator of a vehicle shall drive the same upon the right half of the street and shall drive a slow moving vehicle as closely as possible to the right-hand edge or curb of the street unless it is impracticable to travel on such side of the street, and except when overtaking and passing another vehicle subject to the limitations applicable in overtaking and passing set forth in this Ordinance.

The foregoing provisions of this section shall not be deemed to prevent the marking of lanes for traffic upon any street and the allocation of designated lanes to traffic moving in a particular direction or at designated speeds.

Section 35. **Overtaking a Vehicle.**

The operator of any vehicle overtaking another vehicle proceeding in the same direction may pass to the left or the right thereof under conditions to permit safe passage. The operator of such overtaking vehicle shall pass at a safe distance to the side of such overtaken vehicle and shall not cut in front of the latter until safely clear of the overtaken vehicle.

Note to Section 35. The original text of the Uniform Vehicle Code on this subject, which required that all overtaking be on the left, was modified by the National Conference of Commissioners on Uniform State Laws at a meeting at Buffalo, August 28-29, 1927, to provide for overtaking on the right in business or residence streets in cities where this can be done with safety. Section 35 above permits such overtaking on any city street under proper conditions, and is recommended as simpler and more easily enforced than that adopted at Buffalo.

Section 36. **Limitations on Privilege of Overtaking and Passing.**

(2) The operator of a vehicle shall not drive to the left side of the center line of the traversable roadway in overtaking and passing another vehicle proceeding in the same direction unless such left side is clearly visible and is free of oncoming traffic for a sufficient distance ahead to permit such overtaking and passing to be made in safety.

The foregoing provision of this section shall not apply upon one-way streets or upon streets laned for traffic, in which latter event, vehicles traveling in lanes shall move in the direction permitted in such lanes.

(b) The operator of a vehicle shall not overtake and pass any other vehicle proceeding in the same direction at any intersection of streets, except that this provision shall not apply at intersections where traffic is controlled by traffic control signals or by police officers.

Section 37. **Operator to Give Way to Overtaking Vehicle.**

(a) The operator of a vehicle upon a street shall not deviate from his direct line of travel without ascertaining that such movement can be made with safety to other vehicles approaching from the rear and about to overtake and pass such first mentioned vehicle.

(b) The operator of a vehicle upon a street about to be overtaken and passed by another vehicle approaching from the rear shall give way consistent with safety upon suitable and audible signal being given by the operator of the overtaking vehicle, and shall not increase the speed of his vehicle until completely passed by the overtaking vehicle.

Note to Section 37. Section 37 is a departure from the Uniform Vehicle Code made necessary by the provision in Section 35 that vehicles may overtake on either the left or the right.

Section 38. **Turning at Intersections.**

(a) **Right Turns.** The operator of a vehicle intending to turn to the right at an intersection or into an alley or driveway shall approach the point of turning in the line of traffic nearest the right hand edge or curb of the street, and in turning, shall keep as closely as practicable to the right hand curb or edge of the street.

(b) **Turning Left.** The operator of a vehicle intending to turn to the left at an intersection or into a driveway shall approach the point of turning in the lane for traffic to the right of and next to the center of the roadway, and, unless otherwise directed by "turning markers," the operator of a vehicle in turning left at an intersection shall pass to the right of the center of the intersection before turning. Upon streets laned for traffic and upon one-way streets a left turn shall be made from the left lane of traffic.

(c) **Turning Markers.** The (traffic authority) is hereby authorized to place turning markers within or at the entrances to intersections, directing that traffic turning left shall follow a line of travel other than as directed in subdivision (b) of this section. Whenever turning markers have been placed as herein provided, traffic turning left shall follow the line as directed by such markers.

(d) **Turning Left on "Go" Signal.** The operator of a vehicle or street car intending to turn to the left at an intersection where traffic is controlled by traffic control signals or by a police officer, shall proceed to make such left turn with proper care to avoid accident and only upon the "Go" signal, unless otherwise directed by a police officer.

Note to Section 38(d). Where there are exceptions to turning on the green or "Go" signal which controls the straight or through movement, the last line of this subsection should be supplemented by the words "or by official traffic signs, or special signals effective both day and night." (See note to Section 9.)

Section 39. **When Turning Around at Intersections Prohibited.**

At any intersection where traffic is controlled by traffic control signals or by a police officer, it shall be unlawful for the operator of a vehicle to turn such vehicle at the intersection in a complete circle or so as to proceed in the opposite direction.

Section 40. **Turning Around in Midblock Prohibited (Optional).**

The operator of a vehicle shall not within a business district nor upon any through street in a residence district turn such vehicle so as to proceed in the opposite direction except at an intersection.

Section 41. **Emerging from Alley or Private Driveway.**

The operator of a vehicle emerging from an alley, driveway or garage shall stop such vehicle immediately prior to driving onto a sidewalk or onto the sidewalk area extending across any alleyway.

Section 42. **Vehicles Shall Not Be Driven on Sidewalk.**

The operator of a vehicle shall not drive within any sidewalk area except at a permanent or temporary driveway.

Section 43. **Operation of Vehicles on Approach of Authorized Emergency Vehicle.**

(a) Upon the approach of any authorized emergency vehicle or vehicles giving audible signal by bell, siren or exhaust whistle, the operator of every other vehicle shall immediately drive the same to a position as near as possible and parallel to the right hand edge or curb of the street, clear of any intersection, and shall stop and remain in such position until the authorized emergency vehicle or vehicles shall have passed, unless otherwise directed by a police officer; and the operator of every street car shall immediately stop such car clear of any intersection and keep it in such position until the authorized emergency vehicle or vehicles shall have passed, unless otherwise directed by a police officer.

Section 44. **Following Fire Apparatus Prohibited.**

It shall be unlawful for the operator of any vehicle, other than one on official business, to follow closer than five hundred feet any fire apparatus traveling in response to a fire alarm, or to drive into or stop any vehicle within the block where fire apparatus has stopped in answer to a fire alarm.

Note to Section 44. Municipalities may desire to substitute the words "a city block" for the limitation of five hundred feet.

Section 45. **Stop Before Entering Through Street.**

The following streets and parts of streets are hereby declared to constitute through streets for the purpose of this section:

.....

.....

Every operator of a vehicle, street car or other conveyance traversing any street intersecting any through street above designated, shall bring such vehicle, street car or conveyance to a full stop at the place where such street meets the prolongation of the nearest property line of such through street, subject, however, to the direction of any traffic control sign or signal or any police officer at such intersection.

The operator of any vehicle who has come to a full stop as required above, upon entering the through street, as well as operators of vehicles on such through street, shall be subject to the usual right-of-way rule prescribed by law and applicable to vehicles at intersections.

The (traffic authority) is hereby authorized and required to place and maintain or cause to be placed and maintained on each and every street intersecting a through street designated above, and at or near the property line of the through street, appropriate signs upon the street (and in addition thereto may place and maintain any appropriate devices or marks in the roadway), such signs, devices or marks to bear the word "Stop" and to be located in such position and to be provided with letters of a size to be clearly legible from a distance of at least one hundred feet along the street intersecting the through street. All such signs shall be illuminated at night or so placed as to be illuminated by street lights or by the headlights of approaching motor vehicles.

Section 46. **One-Way Streets.**

Upon the following streets, vehicular traffic shall move only in a ( ) direction.

.....

.....

A sign indicating the direction of traffic shall be erected and maintained at every intersection where movement in the opposite direction is prohibited.

Note—Article VII of the Ordinance set forth above includes those regulations covering the operation of vehicles which it is recommended be included in a municipal traffic ordinance, except in case such regulations are in conflict with the state vehicle law, or duplicate provisions in the state law in a state in which legal action must be brought under the state law (and may not be brought under the duplicating local ordinance).

State vehicle laws include additional regulations and rules of the road, such as restrictions as to speed and prohibitions against reckless driving. In general it is believed that such state law provisions need not be and should not

be repeated in municipal ordinances. However, it is recognized that in some states it is necessary for purposes of local enforcement to repeat state law provisions in municipal ordinances, and in some states, furthermore, the matters are not fully covered by the state law. With tions and rules of the road, such as restrictions adapted from the Uniform Vehicle Code approved by the National Conference on Street and Highway Safety immediately follow the proposed Ordinance proper (page 34).

ARTICLE VIII
MISCELLANEOUS PROVISIONS

Section 47. **Motor Vehicles Left Unattended . Brakes to Be Set and Engine Stopped.**

No person having control or charge of a motor vehicle shall allow such vehicle to stand on any street unattended without first setting the brakes thereon and stopping the motor of said vehicle, and, when standing upon a perceptible grade, without turning the front wheels of such vehicle to the curb or the side of the street or highway.

Section 48. **Use of Coasters, Roller Skates, and Similar Devices Restricted.**

It shall be unlawful for any person upon roller skates, or riding in or by means of any coaster, toy vehicle, or similar device, to go upon any roadway except while crossing a street on a crosswalk.

Section 49. **Clinging to Moving Vehicles.**

It shall be unlawful for any person traveling upon any bicycle, motor cycle, coaster, sled, roller skates, or any toy vehicle to cling to, or attach himself or his vehicle to any other moving vehicle or street car upon any roadway.

Note to Section 49. Improper riding in or upon any street car or vehicle is prohibited in Sections 22, 52 and 54.

Section 50. **Unlawful to Drive Through Processions Unless Directed by Traffic Control Signals or by a Police Officer.**

It shall be unlawful for the operator of any vehicle or street car to drive between the vehicles comprising a funeral or other authorized procession while they are in motion, provided that said vehicles are conspicuously so designated. This provision shall not apply at intersections where traffic is controlled by traffic control signals or police officers.

Section 51. **Backing Around Corners or Into Intersections Prohibited.**

It shall be unlawful for the operator of any vehicle to back such vehicle around a corner at an intersection, or into an intersection of public streets.

Section 52. **Obstruction to Operator's View or Driving Mechanism.**

(a) It shall be unlawful for the operator of any vehicle to drive the same when such vehicle is so loaded, or when there are in the front seat of such vehicle such number of persons, as to obstruct the view of the operator to the front or sides, or to interfere with the operator's control over the driving mechanism of the vehicle.

(b) It shall be unlawful for any passenger in a vehicle or street car to ride in such position as to interfere with the operator's view ahead, or to the sides, or to interfere with the operator's control over the driving mechanism of the vehicle.

Section 53. **Crossing Fire Hose.**

No street car or vehicle shall be driven over any unprotected hose of the Fire Department when laid down on any street, private driveway or street car track to be used at any fire or alarm of fire, without the consent of the Fire Marshal or Fire Department official in command.

Section 54. **Riding on Handle Bars Prohibited.**

It shall be unlawful for the operator of any bicycle or motorcycle, when upon the street, to carry any other persons upon the handle bar, frame or tank of any such vehicle, or for any person to so ride upon any such vehicle.

Section 55. **Lights on Parked Vehicle.**

Whenever a vehicle is parked or stopped on a street during the times between one-half hour after sunset and one-half hour before sunrise or at any other time when there is not sufficient light to render clearly discernible any vehicle on the street from a distance of 200 feet, there shall be displayed upon such vehicle one or more lamps, projecting a white light visible under normal atmospheric conditions from a distance of 500 feet to the front of such vehicle and projecting a (yellow or red) light visible under like conditions from a distance of 500 feet to the rear, except that such parking light or lights need not be displayed upon any vehicle stopped or parked in accordance with other provisions of this Ordinance upon any brightly lighted street designated by proper authority.

ARTICLE IX
PENALTIES AND PROCEDURE ON ARREST

Section 56. **Penalties.**

Any person violating any of the provisions of this Ordinance or any rule or regulation made by the (Board of Police Commissioners) pursuant thereto, shall be guilty of a misdemeanor, and upon conviction thereof, shall be punished as follows:

Section 57. **Procedure upon Arrest.**

Section 58. **Disposition of Fines and Forfeitures.**

All fines or forfeitures collected upon conviction or upon the forfeiture of bail of any person charged with a violation of any of the provisions of this Ordinance shall be paid into the city treasury and deposited in the ( ) Fund and be expendable for the following purposes:

.....

.....

Section 59. **Effect of Ordinance.**

If any section, subsection, sentence, clause or phrase of this Ordinance is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this Ordinance. The (City Council, Board of Trustees) hereby declares that it would have passed this Ordinance and each section, subsection, sentence, clause and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases be declared unconstitutional.

Section 60. **Repeal.**

Ordinance No. ..... (Former Traffic Ordinance of the city) of this (city) is hereby repealed, and all ordinances or parts of ordinances in conflict with or inconsistent with the provisions of this Ordinance are hereby repealed, except that this repeal shall not affect or prevent the prosecution or punishment of any person for any act done or committed in violation of any ordinance hereby repealed prior to the taking effect of this Ordinance.

Section 61. **Publication of Ordinance.**

The (City Clerk) shall certify to the passage of this Ordinance and cause the same to be published in the ————.

Receptacles for Refuse

The location of the receptacles and the type of receptacles have a very important bearing upon the efficiency of the collection service, and in addition make the streets more presentable upon collection days. In Toronto, Ont., the enforcing of the by-law in this respect is carried out by two inspectors attached to the head office, who work in defined areas each day, distributing warning and notice cards, and advising householders in order that greater co-operation might prevail.

The co-operation of the public is essential, and this can be secured to a great extent by an efficient system. Laxity upon the part of the collection service will soon breed indifference among the householders.

The accompanying cut is a reproduction of one of several notice cards used by the street cleaning department in order to encourage the householders to provide standard regulation receptacles. The card is 6½x3⅝ in., with a blotting surface on the reverse side, and has proven to be very effective.

Cost of Refuse Collection

The following comparative table showing the cost of collecting refuse in the principal cities of the United States and Canada was compiled by a committee and submitted at the 1928 conference of the International Association of Street Sanitation Officials:

City	Population	Cost Per Ton to Point of Disposal
Detroit, Mich.	1,500,000	$6.19
Chicago, Ill.	3,000,000	5.84
New Haven, Conn.	180,000	*5.00
Grand Rapids, Mich.	167,000	4.87
St. Paul, Minn.	325,000	4.75
New Bedford, Mass.	125,000	4.69
Spokane, Wash.	125,000	4.65
Columbus, Ohio	285,000	4.48
Cleveland, Ohio	950,000	4.47
San Diego, Cal.	150,525	4.35
St. Louis, Mo.	830,000	4.33
Boston, Mass.	780,000	4.21
Erie, Pa.	128,000	4.06
Washington, D. C.	500,000	3.92
Utica, N. Y.	108,000	3.82
Long Beach, Cal.	140,000	3.70
Akron, O.	235,000	3.31
Baltimore, Md.	817,000	3.30
Hartford, Conn.	175,000	3.02
Buffalo, N. Y.	560,000	2.87
Toronto, Ont.	570,000	2.84
New Orleans, La.	420,000	2.25
Philadelphia, Pa.	2,089,000	2.21
Montreal, Que.	952,875	2.15
Ottawa, Ont.	127,000	1.37
St. Petersburg, Fla.	150,000	1.37
Houston, Tex.	275,000	1.20
Jacksonville, Fla.	146,700	*.40

*Per cubic yard.

DEPARTMENT OF STREET CLEANING

Height 22 Inches
Diameter 14½ "

NOTICE

Householders will greatly assist in collection of refuse by providing regulation receptacles.

Do not mix ashes with garbage, use separate metal receptacles. Tie all loose paper securely in bundles.

Upon regular collection days, leave receptacles in side entrance, near front corner of building where possible. Do not place at curb.

Your co-operation is requested in an endeavor to improve the appearance of the streets upon collection days.

GEO. W. DIES,
Street Commissioner.

Card Distributed to Householders by Street Cleaning Department of Toronto

Methods and Costs of Constructing Brick Pavements at Gulfport, Fla.

Two Three-eighths in. Vertical Fibre Brick on 4 in. Oyster Shell Base

By Y. BRIDDELL
Superintendent Georgia Engineering Co., St. Petersburg, Fla.

DURING the month of May, 1927, we were awarded a contract for paving 12 streets and avenues in Gulfport, Fla., with 2⅝-in. vertical fibre Augusta block and asphalt filler on a base of compact oyster shell 4 in. in depth. We started this work as soon as the contracts were signed.

Grading Operations.—The grading was done with a Byers Bear Cat skimmer scoop and the excavation hauled to the surrounding lots by wagons. Our cut ran from 6 in. to 4½ ft. in depth, and a great deal of hard pan and muck was encountered which had to be removed and good material hauled in to replace this. After the rough grading had proceeded far enough ahead the setting of the concrete curb began.

Concrete Curb.—The curb used was made of a 1:2:4 mix, and was moulded in slabs 5 ft. long, 4 in. wide, and 14 in. deep. The curb was made in a yard on the railroad siding where the materials were handled but once and this made a saving in the construction of the curb. The curb slabs after being poured were allowed to set 14 days and were wet down each day until thoroughly cured. They then were hauled to the streets and set in place. Out of over 47,000 lin. ft. of curb made and set we lost very little by breakage in hauling and setting. Curbing now being well ahead, the fine grade was surfaced and thoroughly wet and 7-ton roller was placed on this and rolled it until it was well packed.

The Shell Base.—A shell base of clean oyster shell was spread in two layers, each layer being well rolled both straight and at an angle until well packed. Then the shell was tested to see that the total base showed 4 in. in thickness. In connection with this will say that shell will compact approximately 33⅓ per cent under rolling.

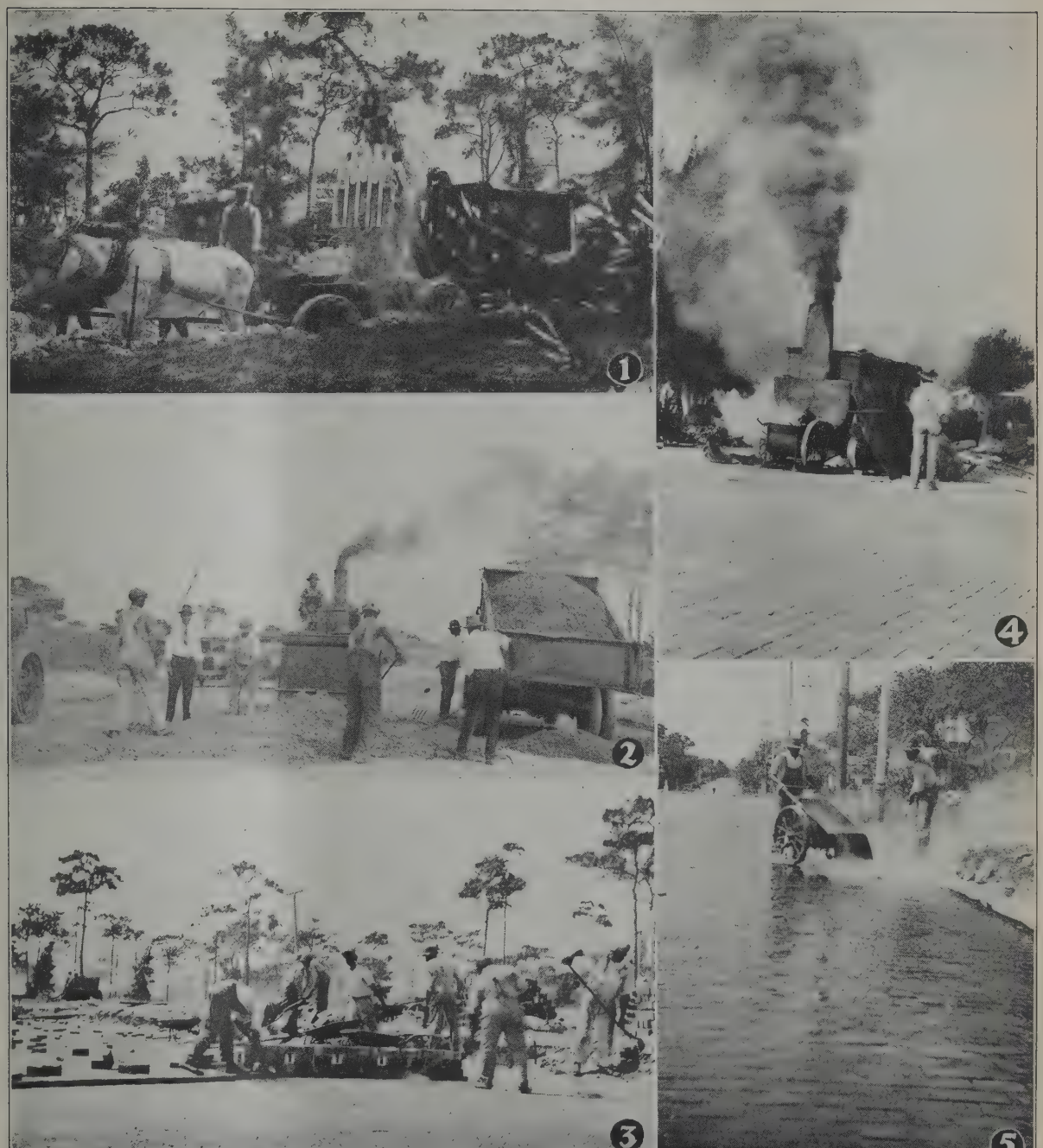
Laying the Brick.—A sand cushion was next spread on the shell base to a depth not exceeding 1 in., and a surface was made by pulling the cushion to a smooth grade with a hand template. Upon the cushion the brick was laid flat in straight rows across the street, broken brick being used to start the rows and make closures at the end of the rows. When the brick had adadvanced far enough ahead inspection was started, and brick which were chipped were turned over and if the other side was found free from chips, cracks, or breaks they were allowed to remain. If both sides were defective it was replaced by a good brick. Following our inspection the city inspector went over the pavement marking out all brick found defective which were missed by our inspection. These we replaced with good brick.

On all of the streets we used a 5 in. gutter and a 5 in. crown. The streets ranged in width from 21 to 27 ft.

Rolling the Surface.—The rolling of the surface was done with a 5 ton roller, starting at the crown of the street and rolling in a straight line up and down the block moving slowly and working its way over towards the curb. When the roller reached the curb, it returned to the crown of the street working its way as before towards the opposite curb. When the straight rolling was finished the roller started at an angle of 45 degrees going from curb to curb. This angle rolling removed the kinks and depressions. The surface was finally inspected by the city inspectors for broken brick which were removed, replaced with good ones and tamped into place.

Pavement Filler.—The pavement is now ready for the filler. If sand filler is used, the sand is hauled or thrown in from the sides of the street, being raked and swept into the cracks until well filled. If asphalt filler is used the

Completed Street at Rolyat Hotel. The White Piles in Gutters Are the Sand That Has Washed Down from Sides. This Will Be Prevented in Future as Soon as Grass Has Been Planted



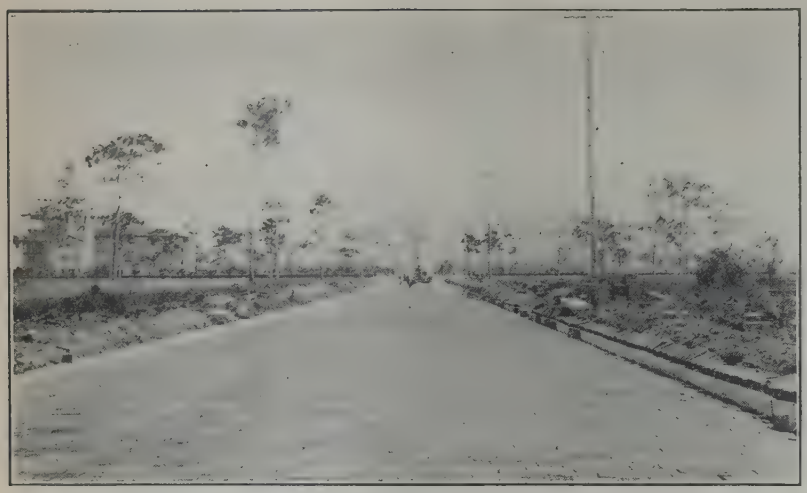
Views of Construction Operations on Brick Paving Job at Gulfport, Fla. (1) Grading with the Skimmer Scoop, (2) Spreading and Rolling Shell Base, (3) Laying the Brick, (4) Heating and Drawing Asphalt, (5) Pouring Hot Asphalt on Brick Pavement

pavement is swept before pouring the asphalt. The asphalt that we used was Texas Number 39 which is a special asphalt for brick pavement. It was heated in kettles until it has reached a temperature of 200°C (392°F) and applied at a temperature not exceeding 350°F). The pouring was done by use of wheel carts which carry the asphalt from the kettles to the pavement. The cracks were filled by pulling a squeegee back and forth until surface is smooth.

Where air pockets formed and bubbles appeared this was touched up with squirt cans until the surface had a smooth uniform appearance. Sand was next thrown on the asphalt and the street is ready for traffic.

Brick.—The bricks used on this contract were the Augusta block made by the Georgia Vitrified Brick & Clay Co., of Augusta, Ga. The following size vertical fibre brick was used 8½ in. x 4 in. x 2⅝ in.

Inspection of all brick was made at the plant at Campania, Ga., by the Nutting Testing Labratory, of Cincinnati, O. This company was employed by Gulfport to make the tests at the plant before shipments were made. Shipments were entirely of No. 1 brick, the requirements being that they must be evenly burned, thoroughly annealed, regular in size and shape, and when broken must show a uniformity of texture and structure and be free from



Section of Road Showing Brick Being Rolled

lime, air pockets, cracks and open or marked laminations. They must not be fire flashed, smoked or treated in any manner tending to give artificially a uniform color outside. Kiln marks must not exceed 3-16 in., and one side at least shall show but slight kiln marks. All brick so distorted in burning as to lay unevenly in the pavement shall be rejected.

Bids.—Bids were asked two ways, cash and certificate plan, the certificate plan being used. This plan gives the property owner the option of paying for his paving all at once, or in ten equal payments at 8 per cent interest per year. All engineering fees legal and advertising costs were charged to the property owner as a part of the total cost. All intersections were included in this cost and were charged to the property owner by taking the entire cost of the street and prorating same per property foot equally. The property owner assume all costs in connection with building of the streets.

Our contract covered five miles of streets, and was completed in 120 days.

Costs.—The itemized costs of the work were as follows:

Grading:	Per Cu. Yd.
Earth Excavation	$0.30
Hard Surface	.40
Shell Base:	Per Sq. Yd.
Shell 4 in. Compacted Sq. Yd.	$0.275
Labor Spreading and Rolling	.046
Cushion Hauled and Spread	.0098
Miscel. Charges	.0202
Total Base	$0.3510
Laying Brick:	Per Sq. Yd.
2½ in. Labor Wet and Roll Foundation	$0.0063
Labor Sand Bed	.0281
Labor Lay Brick	.0291
Inspection	.0178
Labor Batting	.0099
Labor Sanding	.0071
Labor Rolling	.0050
Labor clean up	.0078
Miscellaneous	.0200
Brick lay 34 to Square Yard.	
Asphalt Filler:	Per Sq. Yd.
Labor Sq. Yd.	$0.0217
Asphalt at $26.50 ton	.14449
Miscellaneous Charges	.0100
Texas Filler, run with brick laid flat, 11 to 12 lb. to sq. yd.	
Concrete Curb:	Per. Lin. Ft.
4x14 in., per ft.	$0.37

Note: The miscellaneous charges in the above items, takes care of hauling labor, to and from work, sickness of foremen, idle time by holidays, rain, cashier and superintendent salaries, office rent, gas and oils on cars used on the work.

Wage Rates.—The rates of wages prevailing were as follows:

Common labor, per hour	$ 0.30
Foreman, per week	40.00
Roller operators, per hour	0.70
Bricklayers, per hour	0.50
Batters, per hour	0.35
Truck drivers, per hour	0.55
Skimmer scoop operators, per hour	1.00
Mule skinners, per hour	0.30

Cost of Street Cleaning at Los Angeles, Calif.

The following is taken from the annual report of the Engineering Department of Los Angeles, Cal., of which John C. Shaw is City Engineer. The work is for the fiscal year ended June 30, 1927.

The paved street cleaning branch consists of the downtown congested area, bounded by Figueroa St., Washington St., Macy St., Sunset Blvd. and the Los Angeles River, and is divided into two sweeping districts under the supervision of two sweeping foremen—District No. 1 employing 72 hand-broom sweepers and three 3-ton pickup trucks; District No. 2 employing 68 hand-broom sweepers and three 3-ton pickup trucks, and one team.

This area is patrolled by the street sweepers from 8:00 A. M. until 5:00 P. M., with the exception of the more congested section, which is swept from 5:00 A. M. until 6:00 P. M. The remaining paved streets in the city (not included in the boundary as given above) are swept under the supervision of the district foreman—each foreman having a number of hand-broom sweepers and a 3-ton truck for pick-up purposes. No provision has been made by the city council for any increase in the number of hand-broom sweepers allowed this department for sweeping newly accepted paved streets. Streets are being paved and accepted for maintenance at the rate of approximately 15 miles per month. This division operates 11 motor flushers and six vacuum sweepers. The operation of the flushers and sweepers during the daytime is under the supervision of the street maintenance foreman. The flushers operating on the night shift are under the supervision of a night flushing foreman, and flush the streets in the district bounded by Figueroa St., Santa Barbara Ave., the Los Angeles River and Sunset Blvd.; also any outlying district which is congested by heavy traffic and parking during the day. The volume of day flushing has been materially lessened, due to the fact that approximately 50 per cent of their time is required on wetting down streets for scarifying and oiling jobs, and also, for the sprinkling of detours where new construction work is in progress.

The streets for which no additional hand sweepers have been allowed receive the regular cleaning service that is afforded oiled streets, which is approximately once every four months.

Cleaning Paved Streets

Miles of Paved Streets, July 1, 1926	1,001.10
Miles of Paved Streets, May 1, 1927	1,176.96
Increase of	175.86

Hand Sweeping

	Average Miles Paved Streets	Cost Per Mile Per Day
Streets in congested district	81.49	$10.11
Streets in semi-congested, residential and outlying districts	722.45	1.95
Streets not receiving cleaning service	372.02	.....

Vacuum Cleaning

	1926-1927
Total miles of streets swept	1,577.00
Total machine shifts operated (8 hours)	492.50
Total sq. yds. of surface swept	13,319,377.00
Average miles of streets swept per machine shift	3.20
Average sq. yds. swept per machine shift	27,045.00
Cost per mile of street swept	5.48
Cost per 1,000 yds. of surface swept	64.93

Water Borne Diseases and the Law

A Discussion of Supreme Court Decisions

DECISIONS handed down by the Supreme Courts of various states on the legal responsibility of a city for the quality of the water it supplies its citizens have been collected by James E. Foster. In the June issue of Hygeia, the health magazine published by the American Medical Association Mr. Foster gives an interesting discussion of the conclusions he has reached from a study of these court decisions. We quote from his article as follows:

"The Supreme Court of the State of Washington, Oct. 13, 1925, upheld a verdict for $60,000 previously awarded by a lower court to Gertrude Mary Roscoe against the city of Everett. Mrs. Roscoe sued the city for damages after her husband had died from typhoid, which he contracted by drinking polluted water that had been distributed through the municipal water works system.

"This decision is cited for two reasons. It shows first of all that a city is legally responsible for the quality of the water it furnishes its citizens and is held liable for any illness that may result from the supplying of polluted water. Furthermore, the case in point is sufficiently typical of other decisions to be a fair example of our courts' attitude on this matter.

What the Courts Have Upheld.—In general the courts have upheld the following propositions:

A city is liable for any disease that may be contracted from impurities in the water it distributes. It must therefore keep this water free from pollution.

It cannot shift this responsibility.

It cannot legally dispose of untreated sewage by dumping it into a natural waterway.

If it does so, it is liable for any illness caused its citizens as a result of the polluted condition of the waterway.

The courts base these contentions on the fact that when a city distributes drinking water or disposes of sewage, it enters the field of private business, and as a consequence must be liable for any injuries its activities may cause. In this connection Judge Elliott of the Minnesota Supreme Court said: "When the municipality enters the field of private business, it does not exercise governmental powers. Its purpose is not to govern the inhabitants, but to make for them and itself private benefit. When a municipality enters into a private enterprise for profit, it should have the same rights and be subject to the same liabilities as private corporations or individuals."

Principal cases on legal responsibility for water-borne diseases that have been brought before Supreme Courts: 239 Pacific 831; 97 Minn. 373; 101 Wis. 258; 113 Minn. 55; 73 N. H. 209; 145 Ill. 23; 158 Ill. 21; 87 N.J.L. 106; 154 N.W. 640.

The theory that the city is to be treated as a corporation when it sells water leads to the question: "How would a private company be treated under similar conditions?" In recent years, the majority of the water supply systems have been under municipal operation; however, there have been (and there still are) cities that secure their drinking water from private firms.

City Treated as Private Water Company.—As private water companies were more numerous in the past, cases against them are less common today than formerly. For this reason, it may be permissible to go back a few years to cite a court's attitude on a private concern's responsibility for disease caused by polluted water.

"In 1898, the Wisconsin Supreme Court upheld a verdict brought against the Ashland Water Company. In its opinion the court said that if the company knew or should have known that the water it was distributing was dangerous for domestic use, it was obligated to notify its customers of the condition of this water, and that a failure to do so was a fraud in the eyes of the law.

"From this it can be seen that an independent firm is legally resonsible for the quality of the water it sells. Since a municipaity is to be treated as a private corporation when it supplies water to its citizens, it follows logically that the city should be liable for any injuries it causes its citizens by supplying them with polluted water.

"A Minnesota Decision.—This principle of municipal resonsibility was the subject of an important decision handed down by the Minnesota Supreme Court in 1910. The facts of the case were: Louis Eugene Keever and F. R. Flanagan died from drinking polluted water supplied by the city of Mankato. An investigation showed that sewage was allowed to enter the water works system. The widows of these men sued the city and were awarded damages. The case was brought to the Supreme Court, which upheld the judgment of the lower court.

"Fear of Liability Stimulates Care.—The decision said in part: 'It is obvious that a sound public policy holds a city to a high degree of faithfulness in providing an adequate supply of pure water. Nor does it appear why the citizens should be deprived of the stimulating effects of the fear of liability on the energy and care of its officials; nor why a city should be exempt from liability while a private corporation under the same circumstances should be held responsible for its conduct and made to contribute to the innocent persons it may have damaged.'

"From this decision, one may conclude that when a city supplies its people with water, it must keep this water pure. The city becomes, as far as responsibility is concerned, a private corporation when it operates a water works system, and as a consequence must make financial reparation for any injuries it causes.

"In delivering the opinion in this case, Judge Jaggard made the following statement: 'Public policy requires the conservation of human life, the preservation of public health, and the establishment of public sanitation on a firm and certain basis in the law.'

"City Cannot Shift Responsibility.—The fact that a city cannot shift the responsibility for sickness caused by polluted water was upheld when Mrs. Roscoe sued the city of Everett, Wash. The pollution that was responsible for her husband's death was caused by a by-pass connecting with a local mill. The city knew of this condition and secured a promise from the mill company to remove the injurious by-pass. This promise on the part of the company did not relieve the city of its natural responsibility, and as a consequence, the Supreme Court found the verdict against the city of Everett a just one.

"The right of a city to dispose of its sewage has been limited by the decisions of several state supreme courts. The substance of these decisions is that no city may pollute a natural waterway, and that if it does, it is liable for any ill effects of its action.

"The Supreme Court of New Hampshire sustained a verdict against the city of Dover in which the evidence showed that the city had dumped its sewage into a natural stream with the result that a nearby resident contracted a water-borne disease and died. In its opinion the court stated that a city is liable for negligence in the construction and maintenance of its sewers. In other words, if a city maintains sewers, it must build and operate them in such a way that they will not endanger public health.

"Recent decisions of the Supreme Court of Illinois have been even more specific. In one case the court said that if a city builds a sewer that empties into a creek outside the city limits, it must see that the sewage will flow off without endangering the health of that locality.

"Protection for Those Outside City Limits.—In this decision, it is probable that the reference to the city limits does not restrict the application of the principle of law which guided the court. The case was one in which water had been polluted outside the limits of a city, and as a consequence, the decision was given to apply directly to the problem on hand. The court in fact recognized the broader application of this principle, for in giving its opinion, it said: 'The city has no right to empty the contents of one of its sewers at a point inside or outside of the city, when it may endanger the health or life of a citizen, and escape liability.'

"In another case, the Illinois Supreme Court declared that a municipal corporation cannot empty its sewage into a stream of water when the water will be polluted as a result.

"The first of these decisions of the Illinois court places definite responsibility on the city that dumps its raw sewage into a natural waterway by assuring the injured person of his right to redress. In substance, it says to the cities: 'If you dump raw sewage into natural waterways, you are endangering the health of those who drink this water. If any one is injured as a result of your action, he can collect damages from you in our courts.'

"Stream Pollution Forbidden.—Both of these decisions tacitly recognize the conditions under which a municipal sanitary district operates. Neither, it will be noted, forbids the city to dump its sewage into a stream. Each, however, prohibits stream pollution.

"A city may for practical purposes do one of two things with its sewage. It may collect it and carry it directly to adjoining waterways or it may first treat it so that the water is harmless before it reaches the streams. Under modern conditions, the sewage must be sent to our waterways. The only question regarding its disposal is: Shall it be deposited in our streams in its raw state or shall it first be transformed into harmless water? The Supreme Court of Illinois has recognized present day necessity; instead of prohibiting cities from dumping their sewage into natural waterways, it has told them that if they pollute streams and rivers, they must pay for their carelessness.

"Public Sanitation Must Be Established.—The tendency of state courts is to hold cities responsible for the quality of the drinking water they furnish and for the disposition of the sewage they collect. They recognize that public health work forms an important part of a municipal government's activities, and that the people are entitled to proper protection against the dangers to which an indifferent or a careless city administration might expose them. In spirit they give practical recognition to the soundness of Judge Jaggard's opinion: 'Public policy requires the conservation of human life, the preservation of public health, and the establishment of public sanitation on a firm and certain basis in the law.'"

Payments by Water Department to City for Service of Other Departments

Information on the above subject collected by the Municipal Reference Division of the Seattle, Wash., Public Library for the Water Department of that city, by means of a questionnaire sent to the 33 cities of this country of over 200,000 population, is summarized below.

The following cities reported some payment to city funds:

Akron. Streets and sewers division paid for labor.

Cincinnati. Rent for quarters in City Hall.

Cleveland. $26,000 for rent, heat, light and telephone.

Denver. Gets services of city attorney only. Pays fee for permits to open streets, and annual inspection fees for boiler inspection, etc.

Detroit. Pays for general labor supplied by other departments.

Indianapolis. Private company.

Kansas City, Mo. Rent $500 per month.

Milwaukee. Does not pay for service but gives no free water. Before department became self-supporting it received aid from tax funds amounting to $1,877,538. Surplus earnings of $5,117,965 have since been paid the city.

Minneapolis. $3,500 per year to City Treasurer for clerical help in collection of water bills.

New Orleans. Sewerage-Water Board is a complete organization, distinct from the city government.

New York. No payment, but surplus revenue is paid into the general fund.

Oakland. Private company.

Omaha. Utilities District is distinct from all other city departments. Street Department occasionally renders service and that is paid for. County Treasurer is ex-officio Utilities District treasurer and receives part of his salary from the District.

San Francisco. Private company.

Seattle. Rent for quarters in City Hall. City retains interest on water department bank balances.

The following cities report no payment:

Baltimore, Los Angeles, Louisville, Portland and Washington. Information is not available concerning the remaining cities.

Cost of Refuse Collection at Toronto, Ont.—The total cost of the refuse collection service at Toronto, Ont., for 1927 including administration, insurance, compensation, feeding and care of horses, repairs to vehicles and upkeep of plant, amounted to $1,112,500. The following details are taken from the 1927 report of George W. Dies, Street Commissioner:

Number of buildings collected from	121,062
Collection calls per annum	12,106,200
Actual cost per collection per building	$0.07
Total cost per collection per building	$0.09
Total cost per ton	$2.84
Average tonnage of ashes and garbage collected from each building during the year 1926	4.0
Cost per building per year	$9.19

Thirteenth Century Bridge at Cahors, France. This Structure Has Had Six or Seven Centuries of Use and is Still Serviceable and Shows No Great Deteriation. It Was Built Apparently With the Idea of Permitting Friendly Traffic, But of Preventing Unfriendly Traffic Across the River. The Three Towers Were Each Provided With Gates and Openings Were Left at the Top So That Missiles Could Be Hurled on the Enemy. There Also Were Loops or Portholes for the Small Weapons of the Time

Meter Rates in Municipalities of Over 200,000 Population

Results of a Questionnaire Sent to 34 Cities

SOME interesting information on meter rates in large cities has been obtained recently by the Municipal Reference Division of the Seattle Public Library at the request of the Water Department of Seattle, Wash. Letters were sent to the Water Departments of the 34 cities of over 200,000 population. Through the courtesy of the Municipal Research Division we are able to print below the results of their investigation:

Eight of the 34 departments did not reply. The latest information available for these cities is included for the sake of completeness, with authority given in each case. Very often the only information available was that given in a similar compilation made by the Seattle Public Library in 1924. "1924 information" refers to the former report.

The population figures are U. S. Census Bureau estimates of 1927 unless otherwise stated.

The percentage of metered sources is taken in most cases from a table compiled by the Chicago City Engineer in 1925 and printed in the recent report of the Chicago Department of Public Works on water waste.

Newark has been omitted as no information concerning that city is available.

Akron, O.—(208,435) 1920 census, no. est. 100 per cent metered. First 20,000 cu. ft. per quarter, $1.60 per 1,000; next 20,000 $1.50 per 1,000; next 20,000, $1.40 per 1,000; next 20,000, $1.30 per 1,000; over 80,000 cu. ft., $1.20 per 1,000. Minimum monthly rates: ⅝ in. meter, $1.20 per mo; ¾ in., $2.00; 1 in., $3.00; 1½ in., $4.00; 2 in., $5.00; 3 in., $7.00; 4 in., $10.00; 6 in., $15.00; 8 in., $25.00; 10 in., $40.00.

Atlanta, Ga.—(249,000). Maximum rate 20 ct. per 100 cu. ft.; minimum rate, 10½ ct. per 100 cu. ft. Minimum charge per mo., $1.00 for 500 cu. ft. 1924 rate, no later information received.

Baltimore, Md.—(819,000). 18 per cent metered. First 5,000 cu. ft. per quarter, $2 per 1,000; next 45,000, $1 per 1,000; over 50,000, 75 ct. per 1,000.

(Minimum Quarterly Rates)

⅝ in. meter,	$ 2.00 for	1,000	cu. ft.
¾ in. meter,	3.50 for	1,750	cu. ft.
1 in. meter,	6.00 for	3,000	cu. ft.
1½ in. meter,	10.00 for	5,000	cu. ft.
2 in. meter,	15.00 for	10,000	cu. ft.
3 in. meter,	30.00 for	25,000	cu. ft.
4 in. meter,	50.00 for	45,000	cu. ft.
6 in. meter,	90.00 for	96,667	cu. ft.
8 in. meter,	160.00 for	190,000	cu. ft.
10 in. meter,	225.00 for	276,667	cu. ft.
12 in. meter,	275.00 for	343,333	cu. ft.

Charitable rates: 9 ct. per 1,000 cu. ft. to organizations giving free treatment to over two-thirds of inmates; 12 ct. of free treatment to one-third to two-thirds of inmates; 14 ct. of free treatment to less than one-third of inmates; 39c if no free treatment.

Religious rates: 39 ct. per 1,000 ft.

Educational rates: 48 ct. per 1,000 cu. ft.

Boston, Mass.—(793,100). 94 per cent metered. First 20,000 cu. ft. per year, $1.54 per 1,000; next 20,000, $1.43 per 1,000; next 960,000, $1.32 per 1,000; over 1,000,000 cu. ft., per year $0.88 per 1,000. Minimum charge, $8.80 per year.

Chicago, Ill.—(3,102,000). Meter may be installed on request. 60 ct. per 1,000 cu. ft. 15 per cent discount if paid within 30 days. Information J. Chicago City Council 26 Jan. 1927, p. 5353.

Buffalo, N. Y.—(550,000). First 3,000 cu. ft. per mo., $1.00 per 1,000; next 3,000, 70c per 1,000; over 6,000, 40 ct. per 1,000. Minimum meter rate as follows:

Size of meter	Rate per yr.	Water allowance cu. ft.
⅝ in.	$ 12.00	12,000
¾ in.	15.00	15,000
1 in.	20.00	20,000
1½ in.	30.00	30,000
2 in.	40.00	41,714
3 in.	50.00	56,000
4 in.	100.00	169,000
6 in.	200.00	419,000
8 in.	300.00	669,000
10 in.	400.00	919,000
12 in.	500.00	1,169,000

1924 rate. No later information received.

Cincinnati, O.—(401,247.) 98.6 per cent metered. 12 ct. per 100 cu. ft. Minimum charge, 40 ct. per mo. Charitable rates: Free to the extent of 40 gal. per day per person to charitable institutions; half rates (same limit in amount) to institutions partly supported by fees; ¾ rate to churches, gymnasiums and other community welfare organizations.

Cleveland, O.—(972,600.) 100 per cent metered. 60 ct. per 1,000 cu. ft. Minimum semi-annual rates: ⅝ in. meter, $3.00; ¾ in., $7.50; 1 in., $9.00; 1½ in., $12.00; 2 in., $18.00; 3 in., $37.50; 4 in., $60.00; 6 in., $112.50; 8 in., $200.00.

Columbus, O.—(291,400.) 99 per cent metered. P. W. Je. 1926, p. 187. First 25,000 cu. ft. per mo. $1.20 per 1,000. 25,000 to 200,000 cu. ft., per mo. $1.15 per 1,000; 200,000 to 2,000,000 cu. ft. per mo., $1.10 per 1,000; All over 2,000,000, 60c per 1,000. Minimum charge, 40 ct. per mo. 1924 information with minimum rate as given in Public Works, June, 1926, p. 187.

Denver, Colo.—(289,800.) 2 per cent metered. 1,000 to 15,000 gal. per mo. 17 ct. per 1,000; 15,000 to 30,000, 16 ct. per 1,000; 30,000 to 60,000, 15 ct. per 1,000; 60,000 to 150,000, 13 ct. per 1,000; 150,000 to 315,000, 12 ct. per 1,000; 315,000 to 637,500, 11 ct. per 1,000; 637,000 to 20,000,000, 10 ct. per 1,000; over 20,000,000 gal. per mo., 8 ct. per 1,000. Minimum rate for residence, 25 ct. per month. Minimum rate for business premises, $3.00 per month. No residences are metered. Flat rate for 4-room house, $2.00 semi-annually with 40 ct. additional for every additional 2 rooms.

Detroit, Mich.—(1,334,500.) 99½ per cent metered. First 10,000 cu. ft. per quarter, 65 ct. per 1,000; next 90,000, 50 ct. per 1,000; over 100,000, 40 ct. per 1,000. Minimum charge, $1.25 per quarter. Service charge per year: ⅝ in. meter, $2.40; ¾ in., $3.60; 1 in., $7.20; 1½ in., $14.40; 2 in., $24.00; 3 in., $33.60; 4 in., $43.20; 6 in., $72.00; 8 in., $110.40; 10 in., $158.40; 12 in., $187.20; 16 in., $302.40; 24 in., $532.80.

Indianapolis, Ind.—(374,300.) 30 per cent metered. (Private company.) 1st 700 cu. ft. per mo., 21½ ct. per 100; next 11,300, 14 ct. per 100; next 18,000, 12 ct. per 100; next 20,000, 10 ct. per 100; next 50,000, 8 ct. per 100; next 100,000, 6 ct. per 100. Minimum monthly rates: ⅝ in. meter, $1.50; ¾ in., $4.50; 1½ in., $7.00; 2 in., $11.00; 3 in., $20.00; 4 in., $30.00; 6 in., $50.00. Information from Amer. City Jl. 1926, p. 111.

Jersey City, N. J.—(321,500.) 35 per cent metered. 90 ct. per 1,000 cu. ft. Information from Public Works, Sept. 1926, p. 303.

Kansas City, Mo.—(383,100.) 82.5 per cent metered. First 2,000 cu. ft. 17 ct. per 100; next 2,000, 16 ct. per 100; next 3,000, 15 ct. per 1,000; next 3,000, 14 ct. per 100; next 5,000, 13 ct. per 100; next 5,000, 12 ct. per 100; next 10,000, 11 ct. per 100; next 20,000, 10 ct. per 100; next 50,000, 8 ct. per 100; next 400,000, 7 ct. per 100; all over 500,000, 6 ct. per 100 cu. ft. Minimum charge 50 ct. per month.

Los Angeles, Calif.—(1,200,000), local estimate.) 99 per cent metered. 1st 10,000 cu. ft. per month, 13 ct. per 100; next 40,000, 11 ct. per 100; next 50,000, 9 ct. per 100; all over 100,000, 7 ct. per 100. Minimum charge per month, ⅝ in., ¾ in. or 1 in. meter, $1.00; 1½ in., $1.50; 2 in., $2.00; 3 in., $3.00; 4 in., $4.00; 6 in., $6.00.

Louisville, Ky.—(320,000.) 353 gal. daily or less, 6 ct. per day; 353 gal. per day up to and including first 5,000 gal. daily, 17 ct. per 1,000; then decreasing 1 ct. per 1,000 for each increased 5,000 gal. daily to 8 ct. per 1,000. For all over 50,000 gal. daily, 6 ct. per 1,000. Charitable institutions supplied water free.

Milwaukee, Wis.—(536,400.) 99 per cent metered. 7 ct. per 100 cu. ft. Service charge $2.00 per year.

Minneapolis, Minn.—(447,700.) 100 per cent metered. 8 ct. per 1,000 gal.

New Orleans, La.—(424,000.) 100 per cent metered. Less than 100,000 gal. per mo., 10 ct. per 1,000 gal. All over 100,000 gal. per mo., 7 ct. per 1,000 gal. Service charge per quarter: ⅝ in. meter, 75 ct.; ¾ in., 90 ct.; 1 in., $1.20; 1½ in., $1.80; 2 in., $3.00; 3 in., $4.50; 4 in., $6.00; 6 in., $10.50; 8 in., $18.00; 10 in., $27.00; 12 in., $36.00. One-quarter total consumption, not to exceed 600 gal. per quarter per person, free for sewerage purposes. Information from American City, July, 1926.

New York City—(5,970,000.) 25.7 per cent metered in 1925. 10 ct. per 100 cu. ft.

Oakland, Cal.—(267,300.) 100 per cent metered. (Private company.) First 50,000 cu. ft. per month, 23 ct. per 100; all over 50,000 cu. ft., 19 ct. per 100. Service charge: ⅝ in. meter, 50 ct. per mo.; ¾ in., $1.00; 1 in., $1.50; 1½ in., $2.50; 2 in., $4.50; 3 in., $8.00; 4 in., $12.50; 6 in., $25.00. Subcharge, 10 per cent of charges.

Omaha, Neb.—(219,200.) 97 per cent metered. First 14,000 cu. ft. per mo.; 12½ ct. per 100 cu. ft.; next 36,000, 9 ct. per 100; next 95,000, 7½ ct. per 100; next 1,230,000, 6 ct per 100; all over 2,230,000 cu. ft., 6 ct. per 100 cu. ft., flat rate for total quantity. Minimum monthly rate, 35 ct.

Philadelphia, Pa.—(2,035,900.) 7.7 per cent metered. Minimum meter rates per year and quantities of water allowed therefor.

½ in. ferrule	$ 8.00 minimum,	8,000 cu. ft.
⅝ in. ferrule	12.00 minimum,	12,000 cu. ft.
¾ in. ferrule	18.00 minimum,	18,000 cu. ft.
1 in. ferrule	32.00 minimum.	32,000 cu. ft.
1¼ in. ferrule	50.00 minimum,	50,000 cu. ft.
1½ in. ferrule	75.00 minimum,	75,000 cu. ft.
2 in. ferrule	130.00 minimum,	130,000 cu. ft.
3 in. ferrule	290.00 minimum,	290,000 cu. ft.
4 in. ferrule	515.00 minimum,	515,000 cu. ft.
6 in. ferrule	1,150.00 minimum,	1,150,000 cu. ft.

All water in excess of this fixed amount, 40 ct. per 1,000 cu. ft.

Pittsburgh, Pa.—(665,500.) 40 per cent metered. First 250,000 gal. per quarter, 18 ct. per 1,000 gal; next 250,000, 16 ct. per 1,000; next 250,000, 14 ct. per 1,000; all over 750,000 per quarter, 12 ct. per 1,000. (Public Works, Sept., 1926.)

Portland, Ore.—(258,288, 1920 census, no etsimate.) 100 per cent metered. For the first 20,000 cu. ft. per month, 9½ ct. per 100; all over 20,000 cu. ft., 7½ ct. per 100. Minimum charge, 60 ct. per month.

Providence, R. I.—(280,600.) First 10,000 cu. ft. quarterly, $1.80 per 1,000; next 90,000, $1.20 per 1,000; all over 100,000, 75 ct. per 1,000. Minimum charge, $8.00 per year. 1924 rate. No later information received.

Rochester, N. Y.—(324,500.) 99 per cent metered. First 20,000 cu. ft. or less, per month, $1.35 per 1,000; next 80,000, $1.20 per 1,000; all over 100,000 100,000, 75 ct. per 1,000. Minimum charge $1.50 per quarter.

St. Louis, Mo.—(839,200.) 7.7 per cent metered. Use per 6 mo.

For the first	3,000 cu. ft.	15c per 100
For the next	3,000 cu. ft.	14c per 100
For the next	4,000 cu. ft.	13c per 100
For the next	5,000 cu. ft.	12c per 100
For the next	10,000 cu. ft.	11c per 100
For the next	15,000 cu. ft.	10c per 100
For the next	100,000 cu. ft.	9c per 100
For the next	260,000 cu. ft.	8c per 100
For the next	3,600,000 cu. ft.	7c per 100
For the next	4,600,000 cu. ft.	6½c per 100
For the next	10,000,000 cu. ft.	6c per 100
For the next	18,000,000 cu. ft.	5c per 100

Minimum bill, $1.00. Manufacturing rates to consumers of over 60,000 cu. ft. semi annually; For the 1st 60,000 cu. ft., 10 ct. per 100; next 440,000, 6 ct. per 100; next 500,000, 5½ ct. per 100; for all over 1,000,000 cu. ft., 5 ct. per 100.

St. Paul, Minn.—(250,000.) 99.5 per cent metered. First 10,000 cu. ft. per mo., 9 ct. per 100; 10,000-50,000 cu. ft., 6 ct. per 100; 50,000 to 500,000 cu. ft., 4½ ct. per 100; all over 500,000 cu. ft., 3 ct. per 100. Service charge: ½ in. or ⅝ in. meter, $3.00 per year; ¾ in., $4.20; 1 in., $7.20; 1¼ in., $10.20; 1½ in., $13.20; 2 in., $27.00; 3 in., $60.00; 4 in., $120; 6 in., $240; 8 in., $420; 10 in., $600.

San Francisco, Calif.—(576,000.) 100 per cent metered. (Private company.) First 3,300 cu. ft. per month, 28.8 ct. per 100; next 30,000 cu. ft., 25.2 ct. per 100; all over 33,300, 21.6 ct. per 100. Service charge—monthly: ⅝ in. meter, 78 ct. per mo.; ¾ in., $1.20; 1 in., $1.80; 1½ in., $3.00; 2 in., $5.40; 3 in., $9.60; 4 in., $15.00; 6 in., $30.00; 8 in., $48.00.

Seattle, Wash.—(315,312.) 100 per cent metered. 500 cu. ft. or less, 50 ct. per mo.; over 500 cu. ft., 6 ct. per 100 cu. ft. For manufactories, laundries, motors and elevators, water in excess of 30,000 cu. ft. per mo., 4 ct. per 100 cu. ft.

Toledo, O.—(305,400.) First 10,000 cu. ft. per mo. $1.00 per 1,000; next 150,000, 90 ct. per 1,000; next 1,000,000, 70 ct. per 1,000; over 1,160,000, 50 ct. per 1,000. Minimum monthly charge, 80 ct. Information from Toledo City Journal, June 19, 1926.

Washington, D. C.—(540,000.) 86 per cent metered. Minimum rate, $5.65 per year for 7,500 cu. ft. of water. All in excess of this amount, 5 ct. per 100 cu. ft.

Sanitary Agreement Adopted by Great Lakes States

At a meeting of executive health officers of Minnesota, Michigan, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania and New York, held March 7 at Gary, Ind., these officials drafted and signed the Great Lakes Drainage Basin Sanitation Agreement, the purpose of which is defined in the following resolution:

"Resolved, That the Departments of Health of the States of Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York, represented by the executive health officers of said departments of health, do hereby agree to co-operate with each other and with the United States Public Health Service in carrying out a policy for the improvement of the quality of the waters of these interstate lakes and their tributary streams in these states by the prevention or correction of undue pollution thereof, to the end that the said lakes and tributary streams may be maintained or rendered suitable sources of public water supplies as aforesaid."

Dr. W. F. King, health officer of Indiana, was elected chairman and Dr. I. D. Rawlings, health officer of Illinois, secretary.

The agreement conforms to the general lines and is for similar purpose, as affecting the Great Lakes, as the Interstate Agreement of the Ohio River Drainage Basin, which has been in effective operation for nearly four years.

Influence of Trade Wastes on Sludge Digestion

Preliminary studies of the influence of trade wastes upon sludge digestion were conducted in 1927 by the laboratory of the Department of Sewage Disposal, New Jersey Experimental Station, New Brunswick, N. J. The results of these studies are given in the April 20, Public Health Report by William Rudolfs, Chief of the Department. His summary of results is as follows:

Preliminary studies on the effect of certain trade wastes upon the rate of sludge digestion show that with seeded material—

1. Laundry waste is somewhat detrimental to digestion activities.

2. Sulphur-black dye waste is particularly detrimental when left in contact with the sludge. It is detrimental to a much lesser extent in the digestion of fresh solids when the dye waste is partly removed with some of the supernatant liquid.

3. Comparatively small quantities of H_2SO_4 did not seem to affect digestion processes markedly during the first stages of digestion, and appeared to stimulate them somewhat after a prolonged period of incubation. Larger quantities appeared to retard.

4. Small quantities of NaOH retarded activities slightly and larger quantities more.

5. A mixture of NaOH and H_2SO_4 seemed to be detrimental at the beginning, but this was reversed later.

6. Certain proportions of iron sulphate have little effect on digestion.

Cost Accounting System of the City of Minneapolis

Cost Keeping for Public Work Required by State Law

By GUSTAVE A. MOE
Cost Accountant, Office of City Comptroller, Minneapolis, Minn.

WHILE cost accounting in public service is still in its infancy, Minneapolis has begun by installing a cost accounting system, which is supported by a city ordinance which was passed in July, 1926, setting up the system under the direct supervision of Mr. Dan C. Brown, City Comptroller. Mr. Brown appointed the writer on Aug. 1, 1926 to make the installation and it is the desire to explain in this brief article what has been accomplished since that time.

The State Law.—The state law which compels each political subdivision of the state to keep costs, contains the following provisions:

CHAPTER 274—H. F. NO. 1111.
AN ACT TO REQUIRE MUNICIPALITIES AND POLITICAL SUBDIVISIONS OF THE STATE OF MINNESOTA TO KEEP COMPLETE AND ACCURATE ACCOUNTS OF ALL PUBLIC WORK AND CONSTRUCTION AND OF THE COST THEREOF, DONE FOR OR ON BEHALF OF SUCH MUNICIPALITIES AND POLITICAL SUBDIVISIONS.

Be it enacted by the Legislature of the State of Minnesota.

Section 1. MUNICIPALITIES TO KEEP RECORDS OF COST OF PUBLIC WORKS. NOTICES OF COSTS SHALL BE PRINTED: Whenever a county, city, village, borough, school district or other political subdivision of the State of Minnesota, or any public agency of such municipality or political subdivision, shall determine that any public work or construction is necessary to be done, either by contract or by day labor, or otherwise, an estimate of the cost thereof shall be made, and if such estimate shall exceed the sum of fifteen hundred dollars ($1,500.00) the total amount of such estimate shall be published in the official newspaper of such county, municipality, or political subdivision. If there be no such official paper, the same shall be published in a legal newspaper of the county in which the work is to be done. If the estimated cost of such public work or construction exceeds the sum of fifteen hundred dollars ($1,500.00), such municipality, political subdivision, or public agency shall keep and preserve an accurate record and account of such work and construction, and the cost thereof, whether it be done by contract or by day labor or otherwise. Provided, that where such estimate is published as part of the official proceeding of the governing body of such municipality, public agency or political subdivision, no further publication shall be required under the provision hereof.

Section 2. WHAT SHALL BE SHOWN IN ACCOUNT: The said account shall show in accurately tabulated form, under appropriate heads, the totals of all classes, kinds and descriptions of work performed and of materials entering into such public work or construction, and the cost to such municipality, political subdivision or public agency of each, including the cost of all materials, supplies and services furnished or paid for by said municipality, political subdivision or public agency; and the cost of all labor, when said work or construction is done by day labor, when such public work or construction is done by contract the prices paid to the contractor for, and the amounts paid to him for each class, kind or description of work performed, and materials furnished; and in all cases, the cost of all overhead, the cost of engineering, and all other expenses involved in the total cost of such public work or construction, which total shall be tabulated and distinctly shown.

Section 3. TOTAL COSTS SHALL BE PUBLISHED: The total cost of such public work or construction, upon completion thereof, shall be published in a legal newspaper in the county, city, town, borough or school district in which said work is done, if there be such newspaper published therein. If not, then in some legal newspaper published at the county seat of the county in which said work or construction is performed.

Section 4. RECORDS TO BE OPEN TO THE PUBLIC. CERTIFIED COPIES: The records and accounts hereinabove required to be made and kept, shall be open to inspection by the public at all reasonable times. Certified copies thereof shall be furnished to any citizen of this State on demand, on payment of the legal fee for making and certifying the same.

Section 5. This act shall take effect and be in force from and after its passage.

This state law is made in part a city law by the passing of the above named ordinance establishing the authority for enforcement with the proper city accounting official.

The Four Elements of the Cost Keeping System.—The system is based on the analysis of the four basic elements of expense without which no construction or maintenance can be done, namely, labor, material, equipment and burden or overhead. The success of any system depends upon the personnel which is to handle the system; in short, the system will be no better than the personnel chooses to make it, therefore the educational feature, reflecting to those who give the cost accountant the data, is very necessary. The cooperation between the personnel, such as timekeepers, storehouse clerks, receiving clerks, foremen and engineers in charge of the projects is very necessary to the success of a proper functioning cost accounting system.

The general ledger accounts must necessarily reveal a picture through proper control accounts to which cost accounts may be reconciled. All of the above procedure has been taken by steps to the point of progress now attained.

Before those in charge of the field crews go into the field to construct any public improvements they are called together for the purpose of explaining the manuals that have been prepared and that they may ask questions concerning parts of the procedure not clear to them. These men represent those in charge, such as engineers, foremen, timekeepers and field clerks. This has done much to help the cost accounting movement. At present it is quite noticeable that these men are vitally interested in the costs of their jobs.

Classification and Distribution of Labor.—Labor is divided into two classes—direct labor and indirect labor. Each class is distributed to operation or expense accounts of a project or division of work. Labor distribution forms are used for each type of construction work. Indirect labor charges are applied by the cost clerks of the various departments who also tabulate and report to the heads of departments, the progress and cost daily of each project. On small crews the foreman makes out the labor distribution for his crew, but on large crews a timekeeper is allowed. This timekeeper checks the men four times a day and makes all reports to the foreman.

Materials are handled through classified stores control accounts and warehouse materials are kept by perpetual inventory and stores control accounts. The foreman reports materials used or transferred from job to job upon forms provided for the purpose. All jobs are checked as to the theoretical amounts required and all irregularities are reported promptly.

A master control is also maintained, controlling receipts and disbursements of all materials and supplies purchased —which purchases are made through a central purchasing agent.

Equipment Records.—Equipment records are kept to show the expense and income for all equipment. Each piece of equipment is kept separately so far as expense of operation and maintenance is concerned. Repair shops are governed by a standard cost per each operation of repairs; yard mile, ton mile and units of all operations are compiled. Rental schedules are set up and controlled by the cost accounting department. Rates are continually analyzed as to actual cost against established rates. Changes are made when irregularities are discovered. Much time and care is given to this class of changeable expense.

Spreading Overhead Charges.—Burden and overhead charges are budgeted and scheduled by the cost department for each branch of the city government. These call for very careful analysis, based on previous experience. By this class of expense is meant—engineering, office expense, workmen's compensation, warehouse service expense—and one item of general expense. The latter item carries to each project its charge for services rendered by the various city departments, namely, city engineer, civil service, purchasing agent, city attorney, clerk, treasurer and comptroller.

At present a flat rate for general expense is used.

After having carefully allocated to a job, which in each case is given a number—all of the items of expense as mentioned, then the quantities of work done are assembled to ascertain a unit cost for each of the various operations on a given project. This is what the supervisors want. They like to have this information when it is hot and the cost clerk does his best to fulfill his duty.

Minneapolis does most of the construction work under the supervision of the city engineer by day labor, therefore it is the desire of the cost accountant to see to it that all costs are carefully allocated to a job and that no job pays more or less than its actual cost—which of course is assessed to the property owners on paving, sewers, curb and gutter and street improvements, such as grading and filling.

Installations and assistance in cost accounting have been given to nearly every city department by personal contact since this new system developed. It is the desire of the comptroller to present actual facts so that the public and all concerned will know the actual costs.

As the system grows, the value of it will perhaps be more noticeable as one of the most valuable facts of keeping costs is to be able to make comparisons, and as time goes on this will be possible. A large saving to the public is looked for by the aid of the cost accounting.

City Engineer's Department Has System for Recording Property Ownership

A valuable system of recording land ownership in the city of Hartford, Conn., has been in use in the city engineer's office for many years. The department has a set of maps on which all property transfers are posted each month as they are recorded at the town clerk's office. This set of maps is the most used in the office, and there are few moments during business hours when at least one of these sheets is not in use, and frequently there are several being consulted by various persons at the same time. These property maps show the size, shape, location and ownership of every piece of land in the city of Hartford, together with building and veranda lines and kindred data.

The following account of the origin of this system and its development is taken from the annual report for year ending March 31, 1927, of Roscoe N. Clark, city engineer.

In 1899 the city first undertook to sprinkle a large number of streets and to assess the cost of this work against the abutting property. The preparation of this assessment was entrusted to the city engineer, who found that compiling this list of 5,300 owners was a considerable task. Realizing that this information was of wide interest, the names and frontages in that first sprinkling assessment were copied onto the property maps which had been made a year or two before.

As this sprinkling assessment was to be an annual task the city engineer began on Jan. 1, 1900, to make note of all real estate transfers recorded each day at the town clerk's office. The next year, 1901, a record of these transfers was kept, arranged alphabetically by streets. In 1902 this was amplified by the introduction of the system now in use, whereby each piece of property is assigned a serial key number on the map and in the files, and abstracts of all transfers of that property are filed on cards under that number. Most of this system seems to have been originated in the office of the city engineer of Hartford. It has excited favorable comment from outsiders many times. That this system of keeping track of land ownership was well planned is borne out by the fact that it has continued in use for over a quarter of a century with only minor changes in the general scheme, though expanded to several times its original volume.

The property map now (1927) consists of 171 sheets, 153 sheets, scale 1 in. equals 50 ft., covering most of the built-up portions of the city, fourteen 100 scale sheets of rural parts of the north and south meadows. It is expected that this number will be increased before the summer of 1927 by the substitution of sixteen 50 scale sheets for four of the present 100 scale ones. Other 100 scale sheets will be replotted as soon as it can conveniently be done, until all developed parts of the city are shown on a scale of 50 ft. to the inch.

During the year just closing 31 new tracings of these property maps were made, either to permit re-drawing some sections or to replace worn out tracings.

The ownership is kept posted on positive prints from these tracings. These prints become badly worn from constant use and from the frequent changes which are plotted on them. During the past year 47 new prints were put into service. In making up each of these prints ready for use on the office counter it is necessary to do several days' work lettering on names, building lines, file numbers, etc., so that the preparation of a new counter print involves as much labor as drawing a new tracing.

A complete set of prints of these property maps, showing ownership, building, etc., but not of building lines as of July 1, 1926, was furnished to the Board of Assessors, just as has been done each year for the past twenty years.

Deeds to the number of 3,922, transferring land, were recorded at the town clerk's office during the fiscal year of 1926-27. Abstracts of all of these were made for the files and the proper changes in ownership were lettered on the maps.

The usefulness of these maps and files is not limited to the service which they render to other city departments. They were originally made to facilitate the preparation of assessments, but they have have been found to be very useful for many other purposes. This department gives considerable service direct to the general public by means of these property maps. They are consulted by real estate agents for data respecting property offered for sale or under appraisal. Title searchers come to this office for the bounds of property which they must describe, and from the file of deed abstracts kept in connection with these maps they obtain a chain of title to help them in their search. Credit men and others call this office to ask the ownership of property. The engineering department answers between 50 and 100 inquiries along these lines each day.

1928 Convention of New England Water Works Association

The 47th annual convention of the New England Water Works Association will be held Sept. 18, 19, 20 and 21 at the Hotel Windsor, Montreal, Que. The preliminary program of the convention follows:

PROGRAM
Tentative—Subject to Change
TUESDAY, SEPTEMBER 18
Morning Session, 10 A. M.

Addresses of Welcome.
Reports of Committees and Officers.
Award of Dexter Brackett Memorial Medal.

Afternoon Session, 2 P. M.

Technical Papers.
Committee Reports.

WEDNESDAY, SEPTEMBER 19
Windsor Hall
Morning Session, 9 A. M.

Technical Papers.

Afternoon Session, 2 P. M.

Technical Papers.

Evening Session, 8 P. M.

Technical Papers.

Oak Room
SUPERINTENDENTS' CONFERENCE
Morning, Afternoon and Evening

Sessions will be devoted to Superintendents' Conference. These sessions will be in charge of Stephen H. Taylor, Supt., Water Works, New Bedford, Mass.

(If you have a subject which you desire to have discussed, please communicate with Mr. Taylor.)

THURSDAY, SEPTEMBER 20
Morning Session, 9 A. M.

Visit to Montreal Water Purification Plant.

Afternoon Session, 2 P. M.

Technical Papers and demonstration of Telavox System by the Westinghouse Co.

FRIDAY, SEPTEMBER 21
Morning Session, 9 A. M.

Technical Papers and Business Session.

ENTERTAINMENT
TUESDAY, SEPTEMBER 18

Evening: Informal reception and dance.

WEDNESDAY, SEPTEMBER 19

10:00 A. M. Sightseeing trip for ladies.
2:30 P. M. Entertainment for ladies.
8:00 P. M. Ladies' reception and bridge, Hotel Windsor.

THURSDAY, SEPTEMBER 20

10:30 A. M. Shopping for ladies. Personally conducted by professional women shoppers.
8:00 P. M. Dinner Dance with entertainment at Hotel Windsor for members and guests.

FRIDAY, SEPTEMBER 21

Specially arranged outing and dinner including river excursion and trip through the Lachine Rapids.

General Design Features of Public Swimming Pools

Some of the Features That Make for Safety and Comfort

By V. M. EHLERS
Chief Sanitary Engineer, Texas State Department of Health, Austin

WITH more than 3,000 swimming pools and bathing resorts in the United States today and many more under construction, it is evident that the desire for this type of sport and recreation is increasing. But today, just any "Ole Swimmin' Hole" won't do. The discriminating taste of the American public demands a great many adjuncts to the swimming pool for health protection which the old aristocratic Roman never dreamed of requiring when he went forth to lave his body publicly. True, he wished to have comfort and beauty in his swimming pool, but he knew nothing of the methods by which certain diseases may be transmitted through water and was therefore little concerned with that phase of swimming pool maintenance.

In quest of positive health garnished with amusement, the modern swimmer finds his playground equipped with the essentials for water and sun baths, and in addition, many contrivances which add beauty or increase the pleasure and comfort to be derived from the sport of swimming. But the patronage of a modern swimming pool in a wide-awake community depends primarily upon the loaction of the pool, its construction and maintenance, and upon its reputation of safety in so far as the transmission of disease is concerned. The designers of swimming pools and the promoters who finance and maintain them very wisely take this into consideration.

A demand for information concerning the swimming pool in its relation to the public welfare caused the Conference of State Sanitary Engineers and the Engineering Section of the American Public Health Association to appoint a joint committee to study the subject. The report of this committee now forms the basis of recommendations in this field. The discussion which follows embraces the committee's report and the writer's personal observations.

Location of Pool.—A central location on a paved street and convenient to street car service should be selected. Ease with which connection can be made to a water and sewer system is an important consideration, and the ground on which the pool is built should permit good drainage and be of a dependable foundation.

Design of Pool.—Most pools are built rectangular, although a circular pool with deep water at the center may be more economical for large installations. Pools must be at least 60 ft. long and 20 ft. wide, with a minimum depth of 3 ft., according to the rule of the American Swimming Association in order for swimming records made in them to be official. However, the size of the pool usually depends upon the maximum probable attendance, the funds available, the size of the site, type of pool desired (fill-and-draw or recirculation), and the uses to be made of the pool, both special and general.

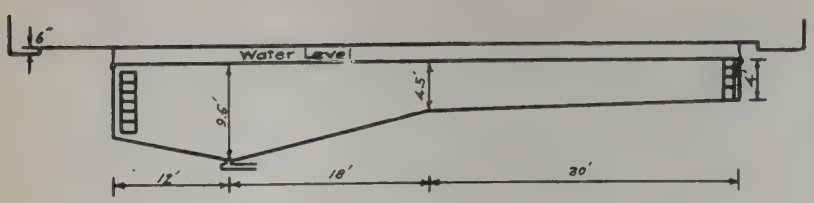
Some designers allow a capacity of 200 to 300 gal. per bather, while the joint committee, assuming that all bathers are not in the water all the time, recommends computing the pool capacity as follows:

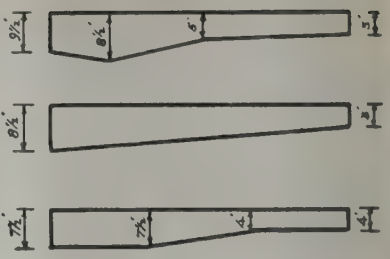
(1) Diving Zone—10-ft. radius of water, 7 to 10 ft. deep, for 12 divers.
(2) Swimming Zone—27 sq. ft. of water for each swimmer in water of 4½ to 7 ft. in depth.
(3) Wading Zone—12 sq. ft. of water for each swimmer in water from 12 in. to 4½ ft. in depth.

Fifty gallons of clean water having a chlorine residual of from .2 to .5 p.p.m. should be added for each bather.

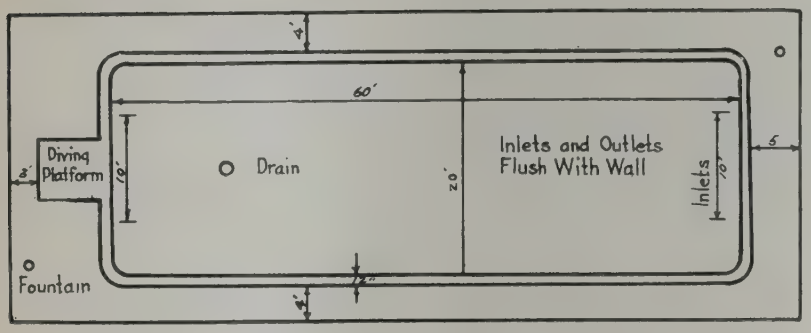
If the flow through the pool is not continuous, the pool should be emptied and refilled after being used in the

An Interesting Example of an Outdoor Swimming Pool

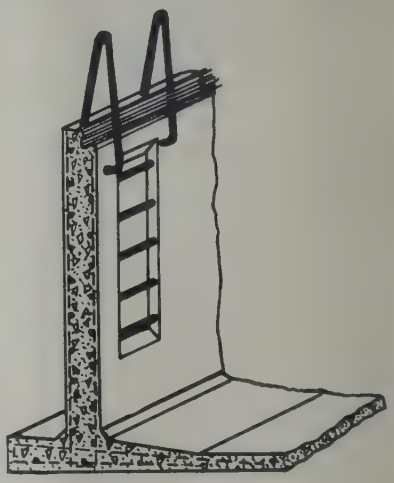




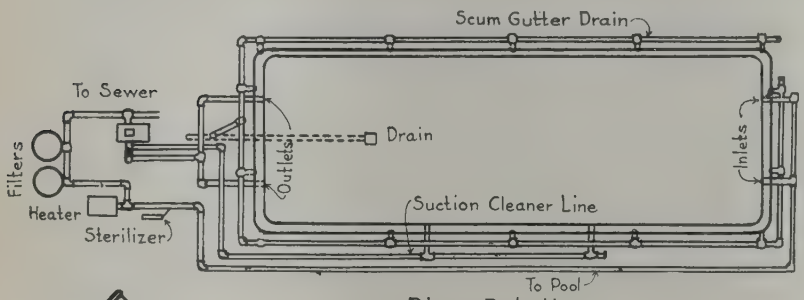
Pool Contours



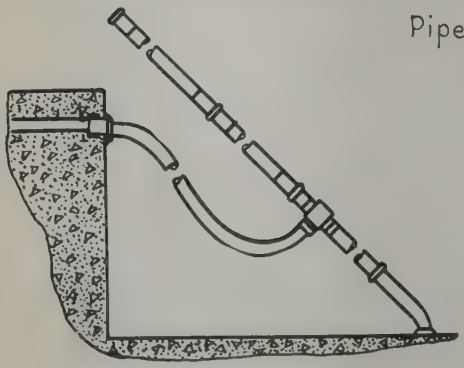
Model Layout



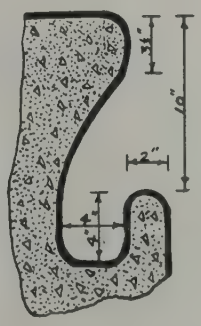
Step Details

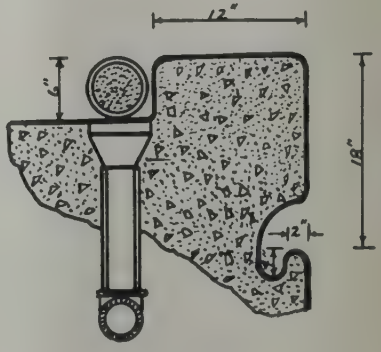


Pipe Details

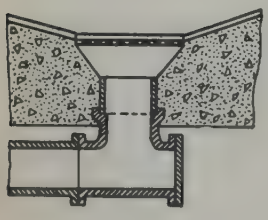


Suction Cleaner





Scum Gutters



Drain

Outlets and Inlets

Details of Swimming Pools Prepared by Division of Sanitary Engineering, State Department of Health of Texas

ratio of one bather for each 50 gal. of water. If disinfection is not continuous, the pool water must be disinfected after being used in the ratio of seven bathers for each 1,000 gal. of water.

It is apparent that these standards set by the committee indirectly taboo the "draw and fill" pool, and advocate the "continuous flow" or "recirculating" type for large installations.

It is estimated that 80 per cent of the patrons stay in water that is less than 4½ ft. deep. Hence, from the standpoint of economy, 75 to 85 per cent of the pool should be designed for non-swimmers. Sudden changes in the depth of the pool should be avoided. A good slope in the shallow end is 1 ft. in 15. The siphon shaped bottom is commonly used in most rectangular pools. The bottom should be smooth, without rough joints or cracks, and the corners rounded. The lining of the bottom and sides should be white or light in color, preferably of tile or glazed bricks for indoor pools. White cement for outdoor pools is better than white paint. End and side walls should be vertical, and the depth of the water should be marked plainly on them. Indoor pools are frequently encased in a steel shell to afford double insurance against leakage.

Scum gutters should extend completely around the pool, recessed into the walls, and deep enough to prevent material from being washed into the pool by a splash or surge. Gutters should have a good slope with a drainage outlet every 10 ft. The edge of the gutter can profitably serve as a hand hold for bathers.

Piping.—The pipe system should be so arranged that water can be drained from the pool, either to the sewer or to recirculating pumps, and provision made against sewage backing up into the pool or drainage lines. The pipe system should include meters, blow-off valves, and valves for taking samples. Water should enter the pool at the shallow end and not more than one foot under the surface, preferably at 10-ft. intervals. There should be sufficient regulating devices to control the flow through the different inlets in order to insure uniform distribution of water throughout the entire pool.

Outlets are placed in the deeper section of the pool, spaced from 10 to 20 ft. apart, and covered with proper grating. Outlet openings should be larger than the discharge pipe in order to minimize suction. The outlet drain to the sewer is necessarily in the deepest point of the pool, and of such size as to permit emptying the pool in three hours.

Special Details of Construction.—Large pools should be built during the cooler seasons of the year. Proper allowance should be made for joint expansion. Floor slabs should not be cast monolithic with walls. Edges of the floor slabs should be provided with preformed, bitumastic expansion joints.

Elevated Chair for Life Guard

Diving Tower and Spring Board at Big Dipper Pool, Iowa City, Ia.

Wall footings may be poured continuous, or with expansion joints brought to a feather edge. If specifications for mixing concrete are rigidly followed, water proofing compounds are not needed to form a dense waterproof concrete. Walls should be poured in 50 or 60-ft. sections with suitable copper and preformed, bitumastic expansion joints.

Stairways should be recessed into the wall and runway of the pool. Steps inserted in the walls are less dangerous than projecting ladders.

Sidewalks and runways should be provided of non-slip finish, and 4 ft. wide (with a slope of ½ in. per foot) extending entirely around the pool. For indoor pools the drainage may go to the scum gutter, but for outdoor installations it is better to connect with the sewer. Desirable proportions for the raised edge of curb are 6 in. in height by 1 ft. in width. Although sand beaches and playgrounds contribute sediment to a pool, they are popular and increase the patronage. Much of the sediment may be kept out by erecting a fence between the pool walk and the sand beach, and this should be provided with a one-way turnstile to the beach walk and a return to the pool by way of the beach walk and through progressive showers and foot bath.

It is quite important that separate space be provided for spectators, and they should not be allowed on the runways or pool enclosure. Galleries should not overhang the pool.

Water Supply and Equipment Details.—For the larger outdoor pools, it is usually more economical to use the water again and again after removing impurities. The equipment required is commonly referred to as a recirculating system and includes pumps, hair catchers, filters, a chlorinator, and pipings to inlets and outlets.

The purification or recirculating system should have a capacity to permit treating the contents of the pool at least twice daily, and oftener where heavy bathing loads are anticipated. Motor driven centrifugal pumps are usually well adapted for recirculating systems.

A water heater is frequently a part of the system. Blowing steam directly into the pool, or the use of heating coils in the pool are both bad practice because of the dangers of burning. A better method is to use a heater for all or part of the return water. The average patron prefers water of a temperature ranging between 72 and 84° F. for swimming pools.

For indoor pools, pressure filters are generally used, while for large outdoor installations which use hard water, the gravity type of rapid sand filter may be more suitable.

The installation of a strainer with slotted openings 1/32 in. in diameter is recommended in order to prevent hair and lint from reaching the filters. The total area of strainer openings should be at least ten times the area of the water inlets.

Every pool should be provided with a suction cleaner. The cleaner may be operated by attachments to the suction of the pump used for recirculating the water. This operation is ordinarily done at night when the pool is emptied and the pump may be appropriated for that purpose.

Chlorine is at present the most acceptable disinfectant for swimming pool waters. Chlorine may be applied either as a gas or in water solution in the circulating water.

Good lighting increases the usefulness of the pool, adds to its attractiveness, and enables life guards to see all parts of the pool clearly. It is therefore essential. Observation towers for life guards should be placed at strategic points.

Sanitary drinking fountains are conveniences which are often times overlooked by the designer. A foot pool, or trough with shower at the entrance to the pool, is required if contamination of the pool water is to be kept down to a minimum.

Diving towers should be well braced, properly anchored, and rigidly constructed. In a public pool, no diving board or platform should be more than 10 ft. above the water level.

Bath Houses.—In the design of the bath house, due consideration should be given to heating, lighting, and ventilating facilities. Floors of all dressing and locker rooms should be of material

impervious to moisture and should have ample floor drains. All walls should be painted or otherwise finished with a waterproof coating.

When lockers are provided, they should be constructed vermin proof. At least one shower and one toilet should be provided for every forty bathers and, in addition, one urinal for every sixty male patrons.

Mechanical Agitators at Knoxville Water Works

Some Notes on the Operation of the New Installation

By W. W. MATHEWS
Of Alvord, Burdick & Howson, Consulting Engineers, Chicago, Ill.

KNOXVILLE, TENN., placed its new water works plant in operation Sept. 1, 1927. This comprises an intake, pumping station and filter plant and coagulation basins. In addition to the plant, two concrete reservoirs were added to the system, having capacities of 1,000,000 and 10,000,000 gal. respectively. Large feeder mains were also laid to strengthen the distribution system.

The Supply.—The source of water supply is the Tennessee River and the intake is located about three mils downstream from the junction of the French Broad and Holston Rivers.

Water from the French Broad River is soft, carrying colloidal clay and color caused by industrial wastes, most of which are organic. The water of the Holston River is hard and clear and is characterized by inorganic wastes, and of the two waters is the easier to clarify.

The ratio of discharge of the Holston to the French Broad River is approximately 3 to 5 and the intake is located on the Holston side of the Tennessee River. In general, the water at the plant is an average of the two waters, although at times one or the other predominates.

The combination of the two waters offers a water easier and more economical to treat than with either one separately. If French Broad water alone was treated, the alum dosage would have to be increased and lime used in combination with the alum. Color removal would require that the dosage be increased and lime would be necessary to counteract the free CO_2.

If Holston River water was treated alone, hardness would present the principal objection and part of this would have to be removed to make the water acceptable to industrial users. At present, one of the large industries located on the Holston River near Knoxville has a small filtration and softening plant, alum and soda ash being used. The deterioration of boiler tubes is presenting such a problem that a careful study is being made to correct the corrosive action of this water.

The water in the Tennessee River, as treated by the City of Knoxville, has presented no such problem.

Colloidal and organic impurities from the French Broad River require a somewhat larger chemical dosage at Knoxville than is required in most purification plants of this character.

The Mechanical Agitators.—After a careful study had been made of the water to be treated, which was available from records kept by the Knoxville Water Department, it was evident that a mixing device was required that would permit varying the period and violence of the mix on short notice. Mechanical agitators were chosen in that elasticity of operation could be effected with simplicity and ease of control.

The mechanical agitators consist of two circular reinforced concrete tanks 30 ft. in diameter and 20 ft. deep in which is placed the stirring mechanism. The mixing period is 20 minutes, using both tanks when the plant is operated at a 15,000,000 gal. rate. Piping to the tanks is arranged so that the tanks can be used singly, in parallel or in series. Raw water enters the tanks at the top and flows out through a 42-in. square opening in the floor of one tank, the opening being placed as near the center of the tank as the shaft supporting the mixing apparatus will permit. About one-third of the water surface in each tank is visible.

The Stirring Device.—The stirring device is on the same general plan as that used in installations of this character. A center shaft of 6-in. pipe carries a cross arm of 2½-in. pipe on which are suspended paddles. These paddles are of steel ⅛ in. thick and the area of the plates is slightly more than 25 per cent of a vertical diametrical section.

Power for operating the stirring device for each tank is from a 3 h.p., d.c. motor and speed variation in the motor is otbained by field control. This ranges from 650 to 1,950 r.p.m. A further reduction in speed is effected by a reducing gear and by a combination of chain and sprockets driving bevel gears. Specifications called for a variation in speed of from 4/10 to 1 and 3/10 r.p.m. of the mixing apparatus which is equivalent to 6/10 and 2 ft. per second peripheral velocity respectively.

Operating Experiences.—Experiments conducted at the plant show that when water from the French Broad River predominates in the Tennessee River, the best results are obtained by operating both tanks in series and with the stirring device rotating at 1 r.p.m. With the Holston River water being treated, a short rapid mix gives the best results. When the French Broad and Holston Rivers are at such a stage, the water is about evenly mixed, the tanks are operated in series, and the agitators operated at an average speed of 1 r.p.m.

Chemical feed piping is so arranged that alum or lime can be fed to either tank and so that lime can also be fed into the clear well. At times, it has been found advantageous to apply the alum ahead of the lime and at other times the best results have been obtained by applying the lime ahead of the alum.

The tanks are constructed so that if it is desired to reverse the direction of flow, through the tank, it can be effected easily. Operating experieence of the past six months shows that the present method of operation is satisfactory and no deposits have occurred in the tanks. Turbidity range is from 50 to 10,000 p.p.m. with an average throughout the year of 800 p.p.m.

Comparison of Chemical Costs.—Comparisons of chemical costs of the last quarter of 1927 operating the new plant with the last quarter of 1926 with the old plant in operation, show that there has been a saving in chemical costs of $1,700, plus treating water of similar character. A substantial saving in chemical costs was to be expected for the new water works supplants one of the oldest filter plants in the country, which has been operated under an overload for several years.

The cost of chemicals per million gallons for last quarter of 1926 and 1927 is listed below. This includes the cost of lime, alum, soda ash (used experimentally in 1926), ammonia and chlorine.

Chemical Cost Per Million Gallons

	1926*	1927**
October	$9.36	$6.96
November	9.31	5.47
December	7.57	4.53

Alum is used as a coagulant with lime being added at intervals as the character of the water requires. This is such a small percentage of the alum used that the table below showing grains per gallon used in the same periods listed above gives an idea of the reduction effected in chemicals by the mechanical mixers in the first three months of operation of the plant.

Alum Dosage in Grains Per Gallon

	1926*	1927**
October	3.34	2.26
November	3.43	2.07
December	2.89	1.72

All of the water works improvements were carired out under the direction of Col. Frederick W. Albert, Engineer in Charge of Water Department. Alvord, Burdick & Howson were Consulting Engineers for the City of Knoxville and the writer was Resident Engineer for the above firm.

Acknowledgment.—The foregoing is an abstract of a paper presented at the 1928 convention of the American Water Works Association.

*Old plant.
**New plant.

Diversions of Funds From Water Departments For Other Municipal Purposes

The Story of "Free Water" in Several American Cities

By HOWELL WRIGHT
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THE study of this problem is worthy of the best efforts of the American Water Works Association. Its solution is vital to the continued operation of the water works as an active self sustaining business or public utility, as well as the efficient operation of other municipal departments. The absolute necessity for such a solution is father to the fact that the problem can be solved. If this association, which is the largest representative of the water works interests in this country, is aroused to energetic action and to the extent of taking the initiative in forming uniform plans for the abatement and final elimination of the diversion of water works funds for other purposes, then this paper will not have been written in vain.

Atlanta, Ga.—The water works department of Atlanta, Ga., is operated in general as though it were a tax supported department. All revenue is placed in the general fund and all moneys for operation and maintenance or extensions and enlargements are appropriated either directly or indirectly from this fund. Water is furnished free for fire protection, public schools, parks, public buildings, cemeteries, street sprinkling, hospitals and all city institutions. It is not furnished free for parochial schools.

Baltimore, Md.—Water rents are diverted into the general revenues of the city but loan funds are not. Appropriations are made annually for the water bureau for operation and fixed charges. Deficits, if any, are made from the tax levy and any surplus is diverted into the general revenue. The city pays for a part of the water it uses for park purposes. Water, however, is furnished free for public schools, fire protection, public buildings and street sprinkling. Parochial schools and cemeteries pay for all the water they use.

About $450,000 or about 13 per cent of the total annual revenue is diverted from water works funds in the form of free services. The Water Bureau pays no taxes nor does it pay its share toward the upkeep of other city departments which may render it service.

Boston, Mass.—Water is furnished to Boston by the Metropolitan District Commission. The city does not pay the commission for any water used for public schools, fire protection, parks, public buildings, nor street sprinkling. Water is not furnished free to parochial schools nor cemeteries. The quantity of water furnished free is about 1 per cent of the total used in Boston. The commission does not pay anything towards the upkeep of city departments which may render it service and is entitled to receive moneys out of taxes in case of deficit growing out of operation and maintenance.

Buffalo, N. Y.—Aside from a small quantity of water furnished free to the State Teachers College and State Hospital for the Insane, there is practically no diversion of funds of any character, the approximate annual cost to the water division for all free services not exceeding $5,000. This is less than 0.2 of 1 per cent of the total revenue. The water division does not pay any money toward the upkeep of any other city department which may render it service.

Charleston, S. C.—The water department of the city of Charleston, S. C., is administered independent of the city council under state law. The commission handles all of its own funds acting as its own sinking fund commissioners. The law provides that the interest on bonds for original purchase or construction and sinking fund for retirement of these bonds shall be taken care of by assessment in the general tax levy if necessary. All fire hydrants and all water up to 300,000 gal. a day are paid for. There are times when water in excess of this quantity is used and for such excess the water works has never been paid. Usually the diversion of funds represented by this excess is small. The water commission has voluntarily contributed a portion of the surplus funds to the general sinking fund. The maximum amount thus contributed in any one year has been $40,000.

Chicago, Ill.—Chicago does not permit direct diversion of water works funds. The water department does, however, furnish water free of charge for public and parochial schools, fire protection, parks, street sprinkling and public buildings. It receives no money from taxes, but pays its share toward the upkeep of city tax supported departments which render it service. There were diverted from the water works funds in 1927 through free service, nearly $2,125,000 or about 16½ per cent of its total revenue.

Cleveland, O.—The water works of the city of Cleveland, during the year 1926, furnished to the city and suburbs a total of 8,245,365,000 cu. ft. of filtered water. Of this quantity, there were approximately 430,000,000 cu. ft. for which the water division received absolutely no pay. If this division had been paid for its product at the present rate of 60 ct. per 1,000 cu. ft., it would have added to its annual revenue approximately $260,000. This diversion from the funds of the water division is made up of non-metered water furnished free of cost to the tax supported city departments for fire protection, street cleaning, sewer flushing, and for use in parks and play grounds and metered water furnished free to public schools, parochial schools, public buildings, city cemeteries, city markets, public libraries and charitable institutions.

The amount of non-metered water used for fire protection, street cleaning, sewer flushing and for parks and play grounds cannot be estimated with any degree of accuracy. The tendency, however, has been to err on the side of conservatism and, to that extent, the diversion of funds is understated. The amount involved however, is probably a comparatively small percentage of the total and cannot therefore affect any conclusions reached. On the basis of the quantity of water estimated, the annual loss to the water division for water furnished for the foregoing city functions, all of which are in connection with some tax-supported department, is approximately $40,000.

Public Schools.—While it has been necessary to resort to estimation in our analysis of certain previously mentioned factors involved in this discussion of the Cleveland situation, the expediency has been avoided in the case of public and parochial schools, hospitals, charitable institutions, public buildings and cemeteries. These consumers are all metered and the amount of the diversion of funds in these particular cases is within the limit of accuracy of the measuring devices used. Those amounts bulk large in total and the legislative body (state and city) was the medium through which most of the diversion takes place. The governing body of the city provided in 1909 "Rules and Regulations" for the use of water. Rule 5 of these regulations stipulates that:

"Water shall be furnished free for

market houses, public school buildings, and other public buildings belonging to the city, and all hospitals, asylums, and other charitable institutions devoted to the relief of the poor, the aged, infirm or destitute persons, or orphan children, upon the following conditions:

The following average daily per capita allowance of free water, based on the average number of inmates and attendants, shall be granted as a maximum free of charge to such institutions, to-wit:

Public schools, 15 gal. per capita, for the average attendance per day during such days as schools are in session.....

.....

All such institutions as enumerated in the foregoing shall pay for all water used or that passes through the meters supplying said institutions, etc., at the City meter rate, for all consumption above the maximum."

While these regulations unquestionably permit the use of free water for the public schools the natural inference would be that if the public schools used more than 15 gal. per capita per day that they would have to pay the water division for all in excess of that maximum. As a matter of fact, however, no such payments have ever been made, although this excess amounted to over 188 per cent in 1924, over 184 per cent in 1925 and nearly 216 per cent in 1926. Until recently it was held that "under the law, boards of education cannot be compelled to pay for water." The supreme court of the state of Ohio has just decided by a majority vote that they can be made to pay. Unfortunately for the Cleveland Water Division, there are certain peculiarities in connection with Ohio law and it is not yet definitely known that this decision is yet enforceable in this district.

During the year 1926, the total value of the water furnished free to the public schools amounted to $105,538.90. The value of the water furnished during the same year in excess even of that allowed by the Council ordinance of 1909 was $72,138.56.

Parochial and Private Schools.—Free water is furnished to parochial and private schools up to the same maximum of 15 gal. per capita per day as is allowed to public schools. Under this regulation, water was furnished free at water works expense during 1926, to the value of $8,614.70.

Charitable Institutions and Hospitals.—Rules and regulations provide that all charitable institutions and hospitals are entitled to free water up to a maximum of 40 gal. per capita per day, for the former and 75, for the latter. In accordance with this stipulation, the water division lost, during 1926, a total revenue of $56,407.60, of which $39,906.80 went to hospitals and the remainder to charitable institutions.

City Markets, Cemeteries and Golf Courses.—City markets, cemeteries and golf courses are supposedly self-sustaining divisions connected with tax-supported departments, yet they pay not one cent for water. There was diverted from water works funds during 1926 to furnish these divisions with free water a total of $5,947.80, of which $4,266 was for the markets, $1,630.80 for the cemeteries, and $51.00 for golf courses.

Private Cemeteries.—There are a total of 16 private cemeteries in the Cleveland district. Of these sixteen, four are furnished with water free of cost. Water to the value of $6,256.10 was furnished these cemeteries during 1926. With the exception of one, no authorization by council has apparently ever been made for this practice. In the case of this exception, the city council in 1895 passed a resolution exchanging "free water in perpetuity for a certain strip of land to be used for street purposes." Since this contract, the water division has furnished free water costing $38,410.90 and the demand for water is steadily increasing.

Public Buildings.—The amounts of money which may be diverted from water works funds in the form of free water for public buildings, such as police stations, jails, workhouses, fire engine houses, etc., is limited only by the needs of the institutions. The celebrated Rule 5 previously mentioned, states that water shal be furnished free of charge to "Police Stations and Jails, Work Houses, Fire Engine Houses, Market Houses, Public Bath Houses and other public buildings 'up to a maximum' as may be estimated by the superintendent of the water department." Under this rule, 35 police stations, 21 fire stations and 16 libraries were furnished during 1926 with water, having a value of $30,280.12. The city hall bill should have been $1,791 during the same period, while that for the market houses is, as previously noted, $4,266.

It should not be considered that the figures given in the preceding paragraphs are unusual. In 1924, the total value of metered free water was $197,228.60 and in 1925, $200,072.50, as compared with $214,787.20 in 1926.

The water division itself pays for everything it receives. It contributes its share toward other City Departments whose services it uses, such as law, civil service, etc. It also pays rent for the use of its quarters in the city hall. All services of all tax-supported departments are paid. If the department of public service repairs the street or sidewalk after a break or after the installation of water main or service connection, the water division pays the entire cost. If the park lawn or shrubs are disturbed by a water main trench, the entire expense of replacement is borne by the water division. The water division itself receives no tax money. There is thus seen to be no compensatory services for that which it furnishes. The free services of this division represent an unqualified diversion of water works funds, a diversion which is not justifiable in logic, in business or in law. The value of this diversion at Cleveland is approximately 5 per cent of the total revenue received.

An ordinance, however, has just been introduced in the city council for the purpose of correcting the present policy of free water. If enacted, this ordinance will place Cleveland in the ranks of the most progressive cities, in that all water furnished will be revenue producing.

Denver, Col.—Direct diversion of water works funds is not permitted in this city and practically no water is furnished free, the city paying for what it uses and in addition paying an annual fire hydrant rental of $22.50 per hydrant. The water works, however, does work for tax supported departments for which it is not paid, such as relaying and lowering water mains and fire hydrants in improvement districts. In 1927 this amounted to over $38,000 which in connection with a small amount for other free services is about 2 per cent of its annual revenue. The water works receives no money from taxes.

Louisville, Ky.—There is no direct diversion of water works funds in Louisville, but water is furnished free to city departments. This includes water for fire protection, parks, public buildings, street sprinkling and public schools. Parochial schools and cemeteries pay for all water used. The water works is operated by a board appointed by the mayor. No taxes are paid nor does the water works receive any tax money. There is no record of the cost of free service furnished.

Milwaukee, Wis.—No diversion of water works funds is permitted in Milwaukee except that approximately $300,000 is transferred annually to the general fund in lieu of taxes. This $300,000 is approximately 12½ per cent of the total revenue of the water department. The city pays for all water used for all purposes. The water department does not receive any money from taxes nor does it pay for any service rendered it by tax-supported departments such as law, civil service, etc.

Philadelphia, Penn.—The entire income from the water works of this city is placed in the general fund from which appropriations are made for any purpose desired by the city council. The city does not pay for any water it uses, free water being furnished for public schools, fire protection, parks, public buildings and street sprinkling. Parochial schools and charitable institutions pay for what water they use at a special rate. The water works does not receive any tax money but any deficit would be taken out of the general fund.

Pittsburgh, Penn.—All revenue received from the sale of water in Pittsburgh, Penn., is placed in the general city fund and the council may appropriate it for any purpose it sees fit. The city does not pay for any water it uses but

water is furnished free to all city departments, to public and parochial schools; for fire protection, parks, public buildings, cemeteries and street sprinkling. Any operating or maintenance deficit is made up from the general fund. The department is operated as though it were tax supported.

Portland, Ore.—Direct diversion of water works funds is not permitted but indirect diversion is practiced in the furnishing of free water for city buildings, parks, street sprinkling and fire protection. Public and parochial schools and cemeteries pay for all water used. There are no publicly owned cemeteries. The water department receives no money from taxes nor does it pay any taxes directly. It pays a rental charge for city hall space, but nothing towards its share of the services of auditor, treasurer, attorney, etc. It is considered that part of the free water to the extent of about $75,000 is an offset against taxes. On this asumption the water works funds are being diverted to the extent of approximately $100,000 per year.

St. Louis, Mo.—The water works of the city of St. Louis does not permit the direct diversion of water works funds. The department does not furnish free water for public schools, parochial schools nor cemeteries. It does, however, furnish it free for fire protection, parks, public buildings and street sprinkling. It pays nothing toward the upkeep of other city departments which render it service. It receives no money from taxes.

San Francisco, Cal.—While the water works of this city is not yet operated as a municipal project, it is proposed that it be controlled by a public utilities commission. If this proposal is accepted in an election to be held August 28th, the use of water works funds will be restricted to water works purposes. The water works will pay for everything it receives and the city will pay for all water and all water works services it may use.

Washington, D. C.—No direct diversion of water works funds is permitted in Washington, D. C., but indirect diversion is practiced in the form of free water to the extent of about 50 per cent of the annual revenue. Water is furnished free of charge for public schools, parochial schools, fire protection, parks, public buildings, cemeteries and street sprinkling. The water works receives no money from taxes nor does it pay any. Neither does it pay anything for such services as law, treasury, civil service, etc.

Conclusions.—It takes but a simple perusal of the foregoing description of how the water works business is being handled in some of the representative cities of the United States to realize the practical chaos that exists. Diversion in some form or other is practiced almost universally. The entire water works situation, today, is in a state of flux, the older tendency being to divert funds at will, at least in the form of service, while the newer, attempts to prevent diversions of any and all kinds. This indeterminate position of publicly owned water works is a detriment to efficient management. It absolutely prevents any just comparison of costs and lays the business open to abuses of many kinds. This is the situation. What is the remedy?

There are but two possible answers to the question. Either publicly owned water works must become tax supported and tax maintained municipal departments or they must function absolutely as publicly owned utility enterprises. The first answer is really no answer at all, for a water works whether publicly or privately owned is basically "..... a commercial enterprise. It serves a limited number of persons ..... it is unlike the city hall in that it does not, or may not, give actual or potential service alike to all the people ....." (Raymond's "The Public and Its Utilities.") The water works cannot therefore function as a tax supported department; it is founded on an entirely different principle. The ability to pay taxes and the desire or capacity to use water meet on no common ground.

This leaves no alternative but the operation of the water works as a publicly owned utility and it cannot be so operated unless it functions as such in its entirety. It not only must render pay for every service it receives, but it must be paid for every service it renders. This eliminates any gifts of taxation but demands pay for all of the product it furnishes. Raymond in his book "The Public and Its Utilities," in the chapter on Texas, reaches this conclusion:

"It is concluded, therefore, with respect to a public utility property, that whether the property be under public or private ownership, it should be assessed and pay taxes as other property and should collect these taxes in turn as a cost of service from those whom it serves; and it is concluded further that if in general it be deemed public policy for any reason not to assess a public utility property when owned by the public, it should be equally the public policy to exempt public utility property from taxation when under private ownership." He also states in his same book under the title of General Considerations in the chapter on Rate Making for Water Service. "It is a cardinal principle, now recognized by courts and commissions, that users of service, either public or private users, should pay for the service in proportion to the costs they entail, and the value of the service rendered; that public service such as fire protection service, sewer flushing, street, park and public building service, should be paid for by the city, and collected in the general tax. It is assumed that such service is for all the people, and that the most equitable way of securing its cost is by assessment in taxes, which may be supposed to distribute the cost somewhat in proportion to the value of the service ..... The principle announced in the first sentence ..... has not been observed generally in the past, and is not observed generally at the present time, although more and more it is being recognized and applied. In many cities owning their own plants, and in some in which the plant is under private ownership, public service is free. This is held to be unfair and of doubtful legality, since it imposes on the private consumers a charge that is properly a public expense chargeable to all tax payers. The free srvice is the enforced gift of the private consumers." This last sentence contains the crux of the entire situation. The fallacy of "free water" is based not on the principle of justice but embodies the doctrine of force. Embodying this doctrine, it contains the seed of elemental destruction. Either free water must be eliminated from water works practice or efficient water works management must go down in failure, with its corresponding effect upon municipal government.

Acknowledgment.—The above is an abstract of a paper presented at the 48th Annual Convention of the American Water Works Association.

Missouri Sewer District Act Held Constitutional

Public Health Reports for June 1, cites the following decision of the Missouri Supreme Court on the validity of the state law for the formation of sewer districts:

"(Missouri Supreme Court; State ex rel. Gentry, Atty. Gen. v. Curtis et al., Sup'rs of Webster Groves General Sewer Dist. No. 1 of St. Louis County, 4 S. W. (2d) 467; decided March 17, 1928.) An act approved March 25, 1927 (Missouri Laws 1927, pp. 439-465), authorized the formation of sewer districts in counties having 75,000 or more population. A quo warranto proceeding was brought to oust certain persons as supervisors of a sewer district, it being contended that the above-mentioned act, under which the supervisors held office, was unconstitutional. Numerous grounds of unconstitutionality were urged but the supreme court ruled against them all, thus holding the law to be a valid enactment."

Booklet on Safe Flying.—"Safety—The First Essential for Progress in Air Transport," is the title of a new booklet just issued by the National Safety Council, Chicago. It contains a foreword by Homer E. Niesz, president of the institution, and an article by Harry F. Guggenheim, president, The Daniel Guggenheim Fund for Aeronautics.

Financing the Operation of Sewage Treatment Plants

Ohio Plan Places Sewerage on Utility Basis

IN 1923 the legislature of the state of Ohio passed a law to provide special revenues for sewerage departments. This statute is known locally as the sewer rental law. Its purpose is to permit municipalities to assess and to collect charges for the use of sewers and to provide for the proper maintenance, operation and control of sewer systems and sewage disposal works. The law is intended to place the sewerage departments of a municipality upon much the same basis as the water department is placed In other words sewerage department will be operated as a utility and placed upon a self-supporting basis by equitable charges for sewerage and sewage disposal service. The state law providing for this is as follows:

SEWER RENTAL LAW

[Section numbers, Ohio General Code. Effective July 30, 1923.]

Sec. 3891-1. The council of any city or village which has installed or is installing sewerage, a system of sewerage, sewage pumping works or sewage treatment or disposal works for public use, may by ordinance establish just and equitable rates or charges of rents to be paid to such city or village for the use of such sewerage, a system of sewerage, sewage pumping works or sewage treatment or disposal works by every person, firm or corporation whose premises are served by a connection to such sewerage, system of sewerage, sewage pumping works or sewage treatment or disposal works. Such charges shall constitute a lien upon the property served by such connection and if not paid when due shall be collected in the same manner as other city and village taxes. The council may change such rates or charges from time to time as may be deemed advisable. Provided, however, that in a municipality operating under a municipal charter the council or other legislative body may establish the schedule of rates herein authorized and provide for its administration by designating the department or officer of the municipality to be charged with the enforcement of the provisions of this act. [110 v. 370.]

Sec. 3891-2. In a city the director of public service shall manage, conduct and control the sewerage system and sewage pumping, treatment and disposal works and when the council has established a schedule of rates or charges of rents for their use shall collect sewer rentals, and he shall appoint the necessary officers and agents for such purposes. [110 v. 370.]

Sec. 3891-3. When the council of a village has established a schedule of rates or charges of rents for the use of the sewerage system and sewage pumping, treatment and disposal works, the board of trustees of public affairs shall manage, conduct and control such sewerage system and sewage pumping, treatment and disposal works and shall collect sewer rentals and shall appoint necessary officers and agents for such purposes; and shall assume all duties, in relation to sewers, imposed upon the street commissioner by Section 4364 of the General Code, whereupon the street commissioner shall be relieved of such duties. [110 v. 370.]

Sec. 3891-4. The director of public service and the board of trustees of public affairs may make such by-laws and regulations as may be deemed necessary for the safe, economical and efficient management and protection of the sewerage system and sewage pumping treatment and disposal works; and for the construction and use of house sewers and connections to the sewerage system. Such by-laws and regulations shall have the same force and effect as ordinances when not repugnant thereto or to the constitution or laws of the state. [110 v. 370.]

Sec. 3891-5. The funds received from the collection of sewer rentals shall be deposited weekly with the treasurer of the corporation. Money so deposited shall be kept as a separate and distinct fund and shall be known as the sewer fund. When appropriated by council, it shall be subject to the order of the director of public service of a city or board of trustees of public affairs of a village. Such director or board shall sign all orders drawn on the treasurer of the corporation against such fund. This fund shall be used for the payment of the cost of the management, maintenance, operation and repair of the sewerage system and sewage pumping, treatment and disposal works and any surplus in such fund may be used for the enlargement or replacement of the same and for the payment of the interest on any debt incurred for the construction of such sewerage system and sewage pumping, treatment and disposal works, and for the creation of a sinking fund for the payment of such debt, but shall not be used for the extension of a sewerage system to serve unsewered areas or for any other purpose whatsoever. [110 v. 370.]

Sec. 4357. In each village in which water works, an electric light plant, artificial or natural gas plant, or other similar public utility is situated, or when the council orders water works, an electric light plant, natural or artificial gas plant, or other similar public utility, to be constructed, or to be leased or purchased from any individual, company or corporation, or when the council shall have determined to establish a schedule of rates or charges of rents for use of the sewerage system and sewage pumping, treatment and disposal works of the village, council shall establish at such time a board of trustees of public affairs for the village, which shall consist of three members, residents of the village, who shall be each elected for a term of two years. [110 v. 370.]

Several municipalities in Ohio have taken advantage of the sewer rental law and have passed ordinances fixing charges for sewer service which will make possible the proper financing of their sewage treatment works. The revenue required in the case of the ordinary village or small city may easily be secured from a flat rate charge and it appears that about $4 to $5 per year per house connection will bring in enough money to take care of the operation charges. Some municipalities have determined upon a graduated scale of charges based upon the water consumption as a measure of sewage flow. In those instances where industries may be provided with private water supplies, estimates of sanitary and industrial sewage may be made.

We are reprinting below the ordinances adopted by three Ohio cities.

DELAWARE, OHIO
SEWER RENTAL ORDINANCE
NO. 1125.

To provide funds for the Maintenance, Operation and Control of the Sewerage System and Sewage Treatment Works of the City of Delaware, Ohio.

Whereas, The City of Delaware, Ohio, has installed a Sewerage System and Sewage Treatment Works, and

Whereas, It is necessary for the preservation of the public health and for compliance with orders of the State Department of Health, that said sewerage system and sewage treatment works be properly maintained, operated and controlled, and

Whereas, Funds for the maintenance, operation and control of said sewerage system and sewage treatment works will not be available from the current operating revenue of the City, and

Whereas, The General Assembly of the State of Ohio has enacted a law, amending Section 4357 of the General Code, to permit municipalities to assess and collect for the use of sewers, said charges to provide for the proper maintenance, operation and control of sewerage systems and sewage treatment or disposal works,

Now, Therefore, Be it Ordained by the Council of the City of Delaware, State of Ohio:

Section 1. That the Director of Public Service be and he is hereby authorized and directed to manage and control the sewerage system and sewage treatment works in a safe, economical and efficient manner.

Section 2. That the Director of Public Service be and he is hereby authorized and directed to make such by-laws and regulations as may be deemed necessary for the safe, economical and efficient management and protection of the sewerage system and sewage treatment works, and for the construction and use of house sewers and connections to the sewerage system; that such by-laws and regulations shall have the same force and effect as ordinances when not repugnant thereto nor to the constitution or laws of the State of Ohio.

Section 3. That the terms and conditions upon which the owners of lots and lands within the corporate limits of the City of Delaware, may connect to the sewerage system either directly or indirectly, shall be as follows:

Article 1. Charges shall be paid at the office of the Director of Public Service, and for each calendar year or part thereof they shall be in accordance with the following schedule of rates:

Dwellings and Apartments
- One-Family (one connection) $4.00 per annum.
- Two-Family (one connection) $7.50 per annum.
- Two-Family (two connections) $8.00 per annum.
- Four-Family (two connections) $15.00 per annum.
- Others (for each family) $4.00 per annum.
- For each additional family on the same connection $3.75 per annum.

Hotels
- For each room with bath $1.75 per annum.
- For each room without bath $1.00 per annum.

Rooming Houses and Fraternities
- Four Dollars ($4.00) per annum plus One Dollar ($1.00) per annum for each person renting a room therein.

Stores, Resturants, Offices and Mercantile Establishments
- Private Toilets, each $4.00 per annum.
- Public Toilets, each $8.00 per annum.
- Kitchen Sinks, each $4.00 per annum.
- Slop Sinks, each $2.00 per annum.

Factories and Shops
- For each and every person employed or engaged in services on the premises, in accordance with the following schedule:
- Ten persons or less, each $1.00 per annum.
- More than 10 and not over 25, 90 cents per annum.
- More than 25 and not over 50, 80 cents per annum.
- More than 50 and not over 100, 70 cents per annum.
- All over 100, 60 cents per annum.

Churches
- For each toilet $2.00 per annum.

Colleges
- All college buildings and dormitories not subject to taxation shall be grouped and the sewer rental fixed on a per capita student population:
- For each registered student 75 cents per annum.

Hospitals and Sanitariums
- Delaware Springs Sanitarium $100.00 per annum.
- Jane M. Case Hospital $60.00 per annum.

Miscellaneous
- For special cases which are not clearly defined in the above schedule, rates shall be established by Council upon the recommendation of the Director of Public Service.

Article 2. Charges shall become due and payable in advance on the first day of January, April, July and October. All bills not paid by the fifteenth of the month in which same becomes due shall be subject to a 10 per cent penalty.

Article 3. Charges shall constitute a lien upon the property served by such connections, and if not paid within ninety days, shall be collected in the same manner as other city taxes.

Article 4. Charges for discharging industrial wastes into the sewerage system shall be fixed by the Director of Public Service and approved by Council.

Section 4. That the funds received from the use of sewers shall be deposited with the Treasurer of the City, and money so deposited shall be kept in a separate and distinct fund and shall be known as the SEWER RENTAL FUND. When appropriated by Council it shall be subject to the order of the Director of Public Service and said Director shall sign all orders drawn on the Treasurer of the City against said fund.

Section 5. Funds received from the use of sewers shall be used for the payment of the costs and expenses of the management, maintenance, operation and repair of the sewerage system and sewage treatment works, and any surplus in such fund shall be used for the enlargement or replacement of the same or for the payment of the interest on any debt incurred for the construction of such sewerage system and sewage treatment works, or for the creation of a sinking fund for the payment of such debt, but shall not be used for the extension of the sewerage system to serve unsewered areas nor for any other purpose whatsoever.

Section 6. That this ordinance constitutes a part of an emergency measure and shall take effect and be in force from and after its passage.

Passed August 1, 1927.
Attest: F. D. King, Clerk.
Attest: H. C. Kent, President of Council.
Approved: H. D. House, Solicitor.
Approved: August 1, 1927.
C. L. Owen, Mayor.

EXHIBIT 4
OXFORD, OHIO.
SEWER RENTAL ORDINANCE
NO. 23.

An ordinance establishing the rates or rents to be paid to the Village of Oxford, Ohio, for the use of the sewerage system and the sewage treatment and disposal works by every person, firm, corporation or institution whose premises are concerned in connection with such system of sewerage and sewage treatment and disposal works.

Be it ordained by the Council of the Village of Oxford, Ohio.

Sec. 1. That there be and is hereby established the rents or charges to be paid the Village of Oxford, Ohio, for the use of the sewerage system and the sewage treatment and disposal works by every person, firm, corporation or institution whose premises are served by a connection to such sewerage system and sewage treatment and disposal works as follows: A rental equal to Twenty-Five (25c) cents per 1,000 cubic feet of water consumed per quarter year, with a minimum charge of $1.25 per quarter year for each sewer service connection from each premise to the sewerage system.

Said rents and charges are to become effective on the 2nd day of January, 1925, and the same are due and payable in April, July, October and January of each year, the first rental charges and rates being due in the month of April, 1925, and payable by the 15th day of the month wherein the same become due.

Sec 2. Said rents or charges shall be collected and placed in a separate sewer fund and dispersed in the manner provided by law.

Sec. 3. This orinance shall take effect and be in force from and after January, 1925, or the earliest period allowed by law.

Passed December 2nd, 1924.
Attest: Retta Hunsinger, Clerk.
(Signed) E. E. Powell, President.

DAYTON, OHIO.
SEWER RENTAL ORDINANCE
No. 13448.*

Fixing the Rates to be Charged by the City of Dayton, Ohio, to the Owners of Benefited Property for the Use of Its Sanitary Sewerage System, or parts thereof, including the Sewage Pumping and Treatment Works.

Whereas, The City of Dayton has built and has in operation a sanitary sewerage system for the purpose of collecting sanitary sewage and conveying the same away from the premises where produced to a place of disposal, and is constructing intercepting sewers, pumping stations, force mains and a disposal works for the treatment of such sewage; and

Whereas, The City Commission finds, in order to promote the public health, safety, welfare and convenience, that a system of sanitary sewerage, including intercepting sewers and force mains, sewage pumping works and a sewage treatment works, are necessary, and that in order to pay the cost of the management, maintenance, operation and repair, or for the enlargement and replacement of the sanitary sewerage system and the sewage pumping, treatment and disposal works and to pay the interest upon the bonds issued and outstanding and to be issued to provide funds for the construction thereof and to retire said bonds as they mature, it is necessary to levy and collect a charge of rental upon the lots, lands and premises served by sewerage connection with the sanitary sewer system of said City; therefore,

Be It Ordained by the Commission of the City of Dayton:

Section 1. It is hereby determined and declared to be necessary and conducive to the protection of the public health, safety, welfare and convenience of the City of Dayton, Ohio, to levy and collect charges or rentals upon all lots, lands and premises served by having connections with the sanitary sewerage system and by the sewage, pumping, treatment and disposal works of said City, the proceeds of such charges or rentals so derived to be for the use of the sanitary sewerage system and the pumping, treatment and disposal works of said city, as hereinafter provided.

Section 2. For the purposes of this ordinance the terms "Sanitary Sewage" and "Industrial Wastes" are defined as follows:

(a) "Sanitary Sewage" is hereby defined as the waste from water closets, urinals, lavatories, sinks, bath tubs, showers, household laundries, cellar floor drains, garage floor drains, bars, soda fountains, cuspidors, refrigerator drips, drinking fountains and stable floor drains.

(b) "Industrial Wastes" are hereby defined as being the liquid waste resulting from any commercial, manufacturing or industrial operations or processes.

Section 3. For the purposes as provided in Sections 1 and 8 hereof there is hereby levied and assessed upon each lot, parcel of land, building or premises having any sewer connection with the sanitary sewerage system of said city or otherwise discharging sewage, industrial wastes, water or other liquids, either directly or indirectly into the City sanitary sewerage system, a sewerage service charge or rental payable as hereinafter provided, and in amount determinable as follows:

(a) For any lot, parcel of land, building or premises, situated within the corporate limits of the City of Dayton, Ohio, and having any connection with the city sewerage system or otherwise discharging sanitary sewage, industrial wastes, water or other liquids, either directly or indirectly, into the City sanitary sewerage system, said charge or rental shall be based upon the quantity of water used thereon or therein as the same is measured by the City water meter there in use, and there shall be charged: for the first 3,000 cubic feet of water, or part thereof, so used per quarter year, the sum of One Dollar ($1.00); for each thousand cubic feet of water used in excess of 3,000 cubic feet and not exceeding 10,000 cubic feet, per quarter year, at the rate of Thirty Cents (30c) per 1,000 cubic feet; for each thousand cubic feet of water in excess of 10,000 cubic feet and not in excess of 20,000 cubic feet, per quarter year, at the rate of Twenty-five Cents (25c) per 1,000 cubic feet; for each thousand cubic feet of water in excess of 20,000 cubic feet and not in excess of 100,000 cubic feet, per quarter year, at the rate of Twenty Cents (20c) per 1,000 cubic feet; for each thousand cubic feet in excess of 100,000 cubic feet and not in excess of 500,000 cubic feet per quarter, at the rate of Fifteen Cents (15c) per one thousand cubic feet; for each thousand cubic feet in excess of 500,000 cubic feet per quarter at the rate of Ten Cents (10c) per 1,000 cubic feet; provided, that the minimum charge shall be One Dollar ($1.00) per quarter year or part thereof.

(b) For any lot, parcel of land, building or premises situated outside of the corporate limits of the City of Dayton, Ohio, and having any connection with the City sanitary sewerage system or otherwise discharging sanitary sewage, industrial wastes, water, or other liquids, either directly or indirectly, into the City sanitary sewerage system, said charge shall be based upon the quantity of water used thereon or therein as the same is measured by a water meter there in use which meter shall be to the approval of the Director of Water, and there shall be charged for the first 3,000 cubic feet of water, or part thereof, so used per quarter year, the sum of One Dollar and Twenty-five Cents ($1.25); for each thousand cubic feet of water used in excess of 3,000 cubic feet and not exceeding 10,000 cubic feet, per quarter year, at the rate of Thirty-eight Cents (38c) per thousand cubic feet; for each thousand cubic feet of water in excess of 10,000 cubic feet and not exceeding 20,000 cubic feet per quarter year at the rate of Thirty-one Cents (31c) per thousand cubic feet; for each thousand cubic feet of water in excess of 20,000 cubic feet and not exceeding 100,000 cubic feet per quarter at the rate of Twenty-five Cents (25c) per thousand cubic feet; for each thousand cubic feet in excess of 100,000 cubic feet and not in excess of 500,000 cubic feet per quarter, at the rate of Ninteen Cents (19c) per thousand cubic feet; for each thousand cubic feet in excess of 500,000 cubic feet per quarter at the rate of Thirteen Cents (13c) per thousand cubic feet; provided that the minimum charge shall be One Dollar and Twenty-five Cents ($1.25) per quarter year or part thereof.

(c) In the event a lot, parcel of land, building or premises discharging sanitary sewage, industrial waste, water or other liquids into the City sanitary sewerage system, either directly or indirectly, is not a user of water supplied by the Department of Water of said City and the water used thereon or therein is not measured by a city water meter, or by a meter acceptable to the Director of Water, then, in each such case the amount of water so used shall be otherwise measured or determined by the Director of Water in order to determine the sewer service charge or rental provided in this ordinance, or the owner or other interested party at his expense may install and maintain a meter acceptable to the Director of Water for said purpose.

(d) In the case a lot, parcel of land, building or premises discharges industrial wastes, either directly or indirectly, into the City sanitary sewerage system, and the Director of Water finds that it is not practical to attempt to measure such wastes by meter, he shall measure such wastes in such manner and by such method as he may find practicable in the light of the conditions and attendant circumstances of the case, in order to determine the sewer service charge or rental, according to the corresponding rates per thousand cubic feet provided in this ordinance.

(e) A discount of five (5) per cent shall be allowed for prompt payment.

In addition to the charge or rental determined according to the rates specified herein a further charge of five (5) per cent of such amount so determined shall be added thereto in each case of failure to make prompt payment, and the total thus obtained shall be the sewerage service or rental in each such case.

The period within which payment shall be made in order to be classified as a "prompt payment" shall be determined by the Director of Water and shall be expressed through the rules or regulations which he is authorized by this ordinance to make for the purposes hereof.

(f) The sewer service charge or rental provided in this ordinance shall be payable quarterly at the office of the Department of Water, and at the option of the Director of Water may be made payable at the same time as water bills in the district in which the property is located are payable.

(g) All lots, lands, buildings and premises located within the corporate limits of the City of Dayton, Ohio, and owned and used by the City School District for school purposes, all lots, lands, buildings and premises located within the corporate limits of the City of Dayton and owned and used by Montgomery County, by the State of Ohio and by the Federal Government for public purposes, together with all lots, lands, buildings and premises owned by the City of Dayton, are hereby exempted from said sewer service charge or rental, provided that nothing herein shall be construed as exempting the Dayton State Hospital for the Insane, the National Military Home for Disabled Soldiers of the United States, or the Wright Field, an aviation field maintained by the United States Government near said City from paying said sewer service charge or rental.

Section 4. For any lot, land, building or premises from which connection is made with the City sanitary sewerage system or which begins to discharge sewage, any industrial waste water or other liquids into the City sanitary sewerage system, either directly or indirectly, after this ordinance becomes effective, a charge shall be made pursuant to this ordinance, the same to be a per diem pro rata amount based upon the minimum rate per quarter from the time such sewer connection is made, or such discharge into the City sewerage system, either directly or indirectly, is begun, until the next following quarter period, except should the measured service exceed the minimum charge the corresponding measured rate or rates shall be charged.

Section 5. The charge or rental levied and assessed by this ordinance shall be payable in four quarterly payments in each year, as provided in Section 3, paragraph (f), hereof, provided that the amount of the rental payable for any lot or premises at the first payment period after this ordinance becomes effective shall be determined on the basis of a per diem prorateement of the minimum charge herein established beginning with the date this ordinance becomes effective, except that in those cases in which the metered or measured charge will exceed the minimum charge, the metered or measured charge shall be the basis.

Section 6. Each charge or rental levied by or pursuant to this ordinance is hereby made a lien upon the corresponding lot, land or premises served by a connection to the sanitary sewerage system of the city of Dayton, Ohio, and if the same is not paid within thirty (30) days after it shall be due and payable it shall be certified to the Auditor of Montgomery County, Ohio, who shall place the same on the tax duplicate of said county with the interest

and penalties allowed by law and be collected as other taxes are collected.

Section 7. The charges or rentals levied pursuant to this ordinance shall be collected by the Department of Water, and the Director of said Department shall make and enforce such by-laws and regulations as may be deemed necessary for the safe, economical and efficient management and protection of the City sewerage system and the sewage pumping, treatment and disposal works, for the construction and use of house sewers and connections to the sewerage system, and for the regulation, collection, rebating and refunding such charges or rentals.

Section 8. The funds received from the collection of the charges or rentals authorized by this ordinance shall be deposited daily with the City Treasury and shall be accounted for and be known as the Sanitary Sewer Fund and when appropriated by the City Commission, shall be available for the payment of the cost and expense of the management, maintenance and repair of the City sanitary sewerage system and the sewage pumping treatment and disposal works, and any surplus in such fund shall be used for the payment of the interest on bonds issued and outstanding or which may be issued to provide funds with which to pay the City's portion of the cost of constructing such sanitary sewerage system, or part thereof, and such sewage pumping, treatment and disposal works and to retire such bonds when they mature, and or for the enlargement or replacement of said sanitary sewerage system, pumping, treatment and disposal works, except that no part thereof shall be used for the extension of such sewerage system into unsewered areas.

Passed by the Commission December 28, 1927.
Signed by the Mayor December 28, 1927.
Allen C. McDonald,
Mayor of the City of Dayton, Ohio.
Attest: E. L. Pletcher,
Clerk of the Commission.

Highland Park, Ill., Takes Bids

HIGHLAND PARK, wealthy north shore suburban community, populated by many of the leading busines men of Chicago, is considering the proposition of constructing a new pumping station, filtration plant, and elevated tank, and it is expected that bids will be taken on this work on July 9. A bond issue of $850,000, it is expected, will be made available for this work, including legal fees and all other necessary related costs.

The existing waterworks includes two intakes in Lake Michigan, 16 in. and 20 in. in diameter, leading to an old steam pumping station, will be replaced by a modern electrically operated plant with gasoline engine driven standbys, according to the proposed plan, together with an up-to-date filtration plant of the required capacity.

The buildings, of structural steel and face brick, and roofed with slate, will be of Georgian architecture, shaped in the form of a T, will have a very pleasing appearance inside and out, and the grounds will be landscaped and extensively planted, and drives will approach the plant from the front, leading to front, side and rear entrances. Filter plant units, clear well, and foundations will be of reinforced concrete. An elevated tank with a capacity of 500,000 gal. and 115 ft. high, will be erected on a hilltop and enclosed in an octagonal brick structure of pleasing appearance. A new 16 in. force main about 7,800 ft. long, will be laid between the plant and this tank.

Pumping Station.—The pumping station will contain 4 low lift pumps as follows:

2 pumps, 3 M.G.D.
1 pump, 7 M.G.D.
1 pump, 9½ M.G.D.

In addition there will be 5 high lift pumps as follows:

1 pump, 2 M.G.D.
2 pumps, 3 M.G.D.
1 pump, 6 M.G.D.
1 pump, 3 M.G.D.

The latter will be a gasoline engine standby. Electric equipment will be provided to permit easy operation from the central switchboard and at the pumps as desired. A new intake well has been design that will allow cleaning of either or both intakes without shutdown and that will permit repairs to one with the other in operation.

Filtration Plant.—The filtration plant, of the rapid sand filter type, has been designed on the basis of a capacity of 7 M.G.D., and contains a clear water reservoir with a capacity of 1,400,000 gal. This plant will contain four filter beds, each of 1¾ M.G.D. capacity, four mechanically agitated mixing basins with a detention period of 50 minutes when all are in operation, and sedimentation basins designed for a detention period of 3 hours. These structures will be reinforced concrete. A chemical room with dosage equipment for both chlorine and alum has been provided, with provision for two chlorinators and two alum outfits.

Construction.—The building will be of structural steel with open steel truss arches over the filter room and trusses over the other departments. The exterior walls will be of face brick, while the interior of the walls will be faced with face brick and glazed brick wainscoting, floors will be of tile throughout, and the roof will be of slate over gypsum roofing. Ornamental brass work will be used on the interior around pump pit wells, and for balustrades and similar work. In all, the construction will be of the best, and in design the structure will be worthy of the high class residential property of the community.

The work has been planned by Pearse, Greeley and Hansen, 6 N. Michigan ave., Chicago, Ill., at which office further information may be obtained.

How Street Parking Affects Street Cleaning

In a paper presented at the last annual conference of the International Association of Street Sanitation Officials, Mr. E. A. Wood, Chief of the Street Cleaning Division of the city of Winnipeg, Man., gave some interesting information on the changes in street cleaning methods due to parking of cars in the business district. An abstract of his paper follows:

The parking of motor vehicles on public thoroughfares is one of the evils of the motor age, and is the cause of much concern on the part of street sanitation officials.

A very large percentage of the motor vehicles of a community are operated for the purpose of carrying on business enterprises of one kind or another either directly or indirectly. Consequently these vehicles, during business hours, operate in the business sections of a city, causing congested conditions on streets in those areas.

Street cleaning officials have learned, through experience, that it is no longer practicable to attempt street cleaning in these areas during business hours, for several reasons. Vehicles parked along the curbs prevent the economic operation of motor pick-up sweepers, they also reduce the width of the street surface available for moving traffic. This causes a heavy volume of traffic in the space between the parked vehicles into which it would be extremely dangerous to attempt street cleaning by the white wing method, and if it were attempted only a very small percentage of efficiency could be expected to result therefrom.

These changing conditions have brought about the practice of street cleaning after midnight in these business areas. Even after that hour, the work of the street cleaning gangs is handicapped by the presence of parked vehicles on streets. To overcome this condition, several methods have been experimented with.

A number of cities have enacted ordinances making it unlawful for vehicles to be parked on streets within a certain specified area between the hours of 12 o'clock midnight and 5 A. M., unless such vehicle is in charge of a competent driver. The driver of said parked vehicle must promptly move same upon the direction of any employe of the street department engaged in street cleaning. In cities where such an ordinance is in force, satisfactory results have been obtained.

In other cities where regulatory ordinances are not enacted, street cleaning officials take the law into their own hands, and wherever a vehicle is found parked on a street in such a manner as to interfere with street cleaning operations, the said vehicle is towed to a side street out of the area of cleaning. This method, while very effective in the majority of cases, is not the ideal condition under which to operate, as it is liable to embroil the city in legal encounters.

Other street cleaning officials are laboring under the handicap of having no regulatory ordinances, or other methods of combating the parked vehicle evil. Needless to say, the highest standard of efficiency cannot be expected under these conditions.

In conclusion, it would appear that street cleaning officials must resort to the enactment of ordinances in order that their necessary work may be carried on, in business sections of cities, without undue interference in the nature of parked vehicles.

Control of Stresses in Large Welded Pipe Line Construction

Results of Study of Pipe Line Stresses

By LLOYD T. JONES and WALTER S. WEEKS
Professors, University of California, Sacramento, Calif.

THE stresses which are met in construction may be divided into the following groups:

Line stress.
Differential-Temperature Stress.
Residual Welding Stress.

Line Stress.—The stress which I thus designate will be best understood by referring to Fig. 1. It is evident that during the forenoon, under a rising temperature several hundred feet of the pipe line will carry outward along the ditch due to compressive line stress. The stress at the free end is zero. At B the stress will be larger than at A, at C still larger, etc. The line stress will be only that which is necessary to move the pipe against earth friction. During the late afternoon and evening the pipe will contract. During the process of retraction there is a tension in the line which I call line tension and which is equal to the frictional resistance of the pipe being pulled back. When the pipe stops contracting this tension remains in the line. As more pipe is added this tension remains and is built permanently into the line. It is present in riveted pipe lines as well as welded ones.

It is not due to any faulty method of construction and it can not be entirely eliminated. Its magnitude in a pipe line of large diameter may be 8,000 lb. per square inch. Laying the line in groups of 20 sections each and joining the groups will reduce this stress to about half as much.

Differential - Temperature Stress. — This is the stress due to the welding or riveting of a pipe line into a straight line at a time when there is a difference of temperature of the top and bottom of the pipe. Differential-temperature stress in large lines is frequently due to a temperature difference as large as 50 deg. F. This temperature difference produces a stress of 10,000 lb. per square inch which will exist in the top fibers when the pipe cools to uniform temperature. This stress can be eliminated by making all girth joints during those hours when top and bottom temperature are equal. The few miles of Mokelumne Line whose girth joints were electric arc welded were made free of differential-temperature stress by welding at night. They did not break.

Residual Welding Stress.—Those of you who may have read the results of the investigation of the welding of the Mokelumne Pipe Line will remember

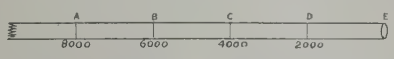


Fig. 1.—Line Stress at Any Point Is the Stress Necessary to Push or Pull the Pipe Extending Beyond That Point. If the Point no Longer Moves Line Stress Remains at the Value when Motion Last Occurred

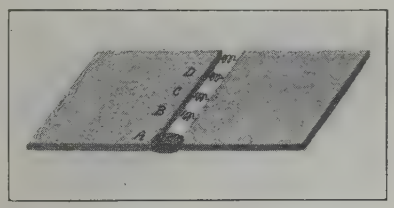


Fig. 2.—The Deformation Produced in Welding Is Due to Expansion of the Heated Metal and the Contraction During Solidification and Cooling

Welding Deformation in Acetylene weld 659 when partially completed. Direction of welding shown by arrows. Deformation accurate to .005"
.5"
1"

Fig. 3.—Deformation Due to Girth Weld in a 65 in. Pipe Line. Width of Shaded Area Represents the Amount of Axial Deformation, if It Is Uniform the Residual Welding Stress Is Usually Slight

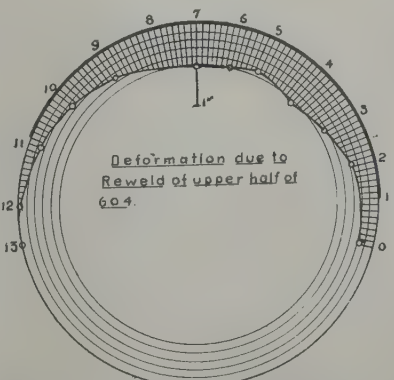


Fig. 4.—Large Deformation in a Particular Reweld of a Broken Girth Joint. The Parent Metal of the Pipe Was Permanently Stretched

the emphasis placed on the seriousness of residual welding stress and may also remember the dismissal of the subject with the statement that in a line properly welded residual welding stress should not exist. By residual welding stress I mean that stress which resides in the completed piece by virtue of the fact that it was joined by welding as opposed to any other method. This stress is due to the shrinkage that occurs in steel during its solidification and cooling to normal temperature. Residual welding stress may be perhaps best illustrated by Fig. 2 which represents two steel sheets being welded edge to edge, the distance apart is exaggerated. Instead of weld metal I have indicated small coil springs joining the two edges. At the start of the weld the metal deposited at A will solidify and will then act as a fulcrum. The metal next deposited at B, C, D, etc., on cooling will produce tension to turn the two sheets about this fulcrum. Unfortunately the problem is complicated by the fact that the fulcrum continually advances.

Figure 3 indicates the deformation in one of the welds of a 65 in. pipe. The deformation, and consequently the residual welding stress, is represented by the width of the shaded area. It was fairly uniform, the maximum being about 0.200 in. A differential deformation of half this much however, represented a stress of approximately 9,000 lb. per square inch.

Figure 4 indicates the distortion which was produced by re-welding the upper half of one joint of a 65 in. pipe which had broken. The portion re-welded is indicated by the heavy black line. The deformation produced by the re-welding is plotted radially and indicated by the shaded area. The upper sheets of these two adjacent sections were drawn together ½ in., with the lower portion of the pipe unmoved, and mind you this metal was ½ in. thick and the pipe 65 in. in diameter. This deformation indicates a stress far beyond the elastic limit of the metal. I indicate this merely to show the serious magnitude of stresses that may be introduced as residual welding stress. It may be of interest to you to know that after that re-weld was completed, even though this great stress was introduced the weld did not again fail.

Method for Eliminating Stress.—There are three ways to produce pipe

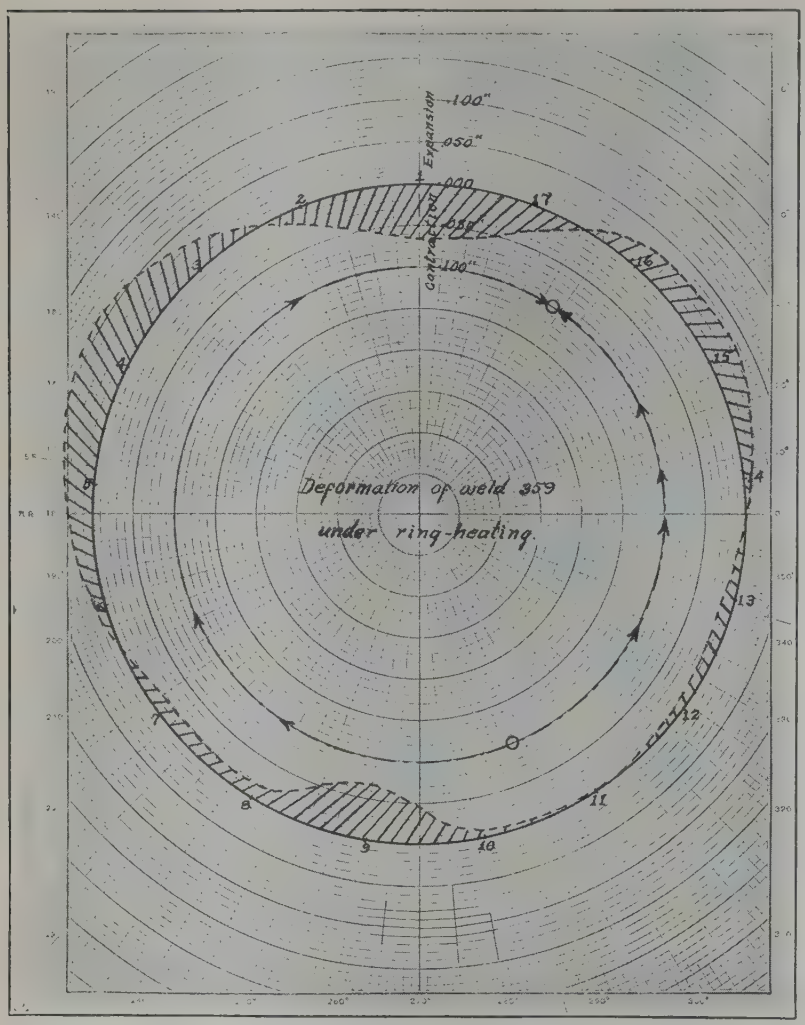


Fig. 5.—Relief of Residual Welding Stress Afforded by Simultaneous Heating of Whole Girth Weld

line girth welds without residual welding stress.

Figure 5 shows the relief of stress that was effected on one particular joint of the 65 in. pipe line by the simultaneous heating of the whole weld. Ten acetylene torches were used to bring the whole weld to a uniform red heat. You will notice that in some places the weld metal elongated and in some places contracted, indicating that forces of tension and compression respectively had existed. While this method has the additional advantage of controlling the crystal structure of the weld metal I nevertheless do not believe that it is economically feasible. While it is a possible method it must nevertheless be disregarded.

A second method is suggested by the discarded one however. If it were humanly possible to produce the whole weld simultaneously or to have the whole weld hot at the same time it would be possible to produce a weld without serious residual welding stress. Although this has been accomplished on small diameter pipe it is not yet suitable for the construction of large lines.

The third method for eliminating residual welding stres was brought to my attention by H. E. Kennedy. It is a method that is new but I say immediately that I have the utmost confidence in it. I have measured welds that have been produced in this manner and have found them to be with virtually zero residual welding stress.

Figure 6 shows adjacent ends of two pipe sections ready to be welded. Each is provided with a narrow flange rolled at right angles to the axis of the pipe. These flanges are placed with their faces in contact and then are welded along their peripheries. The design of the flange is dependent upon the conditions of stress the completed line is to be called upon to withstand. It is happily true that in this weld the residual welding stress is nearly zero. Several types of flange weld have been tested.

Before I present a detailed comparison of the flange weld and its predecessor the butt weld I would like to show you (Fig. 7) comparative values of the residual welding stress of the two types of weld on 16 in. x ¼ in. pipe. The tests on 16 in. pipe were made with the cooperation of R. S. Fuller and R. V. Wilson of the Pacific Gas & Electric Co. You will note that the deformation of the metal of the pipe proper is greater for the butt weld than for the flange weld. May I add the statement that these welds were both made by Mr. Hopkins the same day and under as nearly identical conditions as possible.

These values of deformations are not to be taken too literally. If I were to take sufficient time to present the matter clearly I believe I could prove to you that in these two particular welds the stress in the pipe due to the flange weld does not at any point exceed 3,480 lb. per square inch and that in one portion of the butt weld the stress is equal to the elastic limit of the parent metal. There seem to be two portions of this butt weld that are under compression, the two alternate portions being in tension.

The reasons why pipe line welds break and why they break only part way around and virtually never for the entire circumference are indeed becoming quite clear. A detailed discussion must be postponed however, till more time is available. In justice to butt welds may I state that this particular one is a beautiful weld and that it will never in the world fail, although the metal is severely stressed, because the weld is stronger than the parent metal.

Comparison of Two Types of Welds. —Now let us make a more detailed comparison of the two types of welds.

In the butt weld the residual welding stress is in the plane of the pipe sheet.

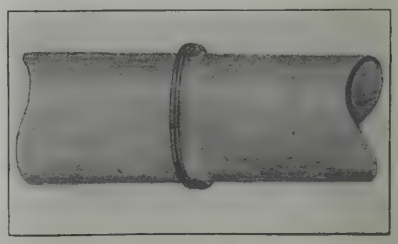


Fig. 6.—Pipe Sections Flanged, Ready for the Peripheries to Be Welded

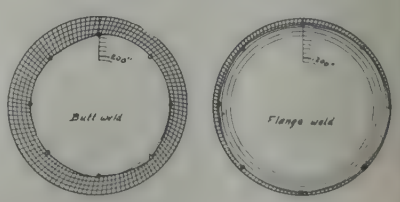


Fig. 7.—Comparative Deformations in Butt Welds and Flange Welds in 16 in. x ¼ in. pipe

In the flange weld it is at the periphery of the flange and can be transmitted to the pipe sheet only by the flange.

The flange is designed to yield by bending long before a serious axial stress in the pipe is reached.

In tests on 16 in. x ¼ in. pipe the elongation was shown to be 0.30 in. per joint before the flange weld showed signs of distress. No buried pipe line will ever be called upon to provide so much motion in relief of stress. The stress equivalent of this 0.30 in. is 40,000 lb. per square inch.

The flange weld is not an expansion joint but rather is an expansible joint which can permanently elongate to relieve excess stress. The butt weld cannot elongate to relieve stress.

The flange weld lends itself admirably to group laying. The joining of groups is less difficult than with the butt weld. It is equally easy to remove a section and replace it as occasion may demand.

The flange weld not only affords relief from residual welding stress but also it functions to relieve line stress, Poisson stress, cold water stress and even differential-temperature stress. These four stresses the butt weld cannot relieve.

With the flange weld there is no accidental formation of stalactites to impede flow.

The relative costs of the two types of weld may be judged from the fact that for the two welds in 16 in. x ¼ in. pipe the flange weld (not including the cost of forming the flange, since it was done by hand) was less than 70 per cent of the cost of the butt weld. Including the turning of the flange by hand it was only equal to the cost of the butt weld.

I repeat that in this weld I have the utmost confidence and I might be accused of not telling the whole truth if I did not state that I consider it to be the most notable contribution to pipe line construction since the advent of welding.

Acknowledgment.—The foregoing is an abstract of a paper prepared by Professors Jones and Weeks, and read by the former at the 1928 convention of the American Water Works Association.

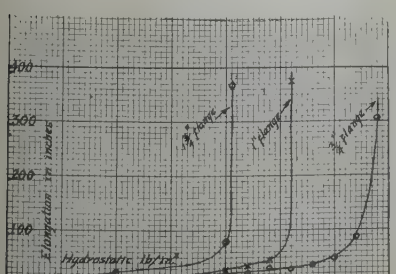


Fig. 8.—Water Pressure Elongation Tests on 16 in. Pipe to Determine the Width of Flange Necessary to Withstand the Stress the Line Is to Undergo

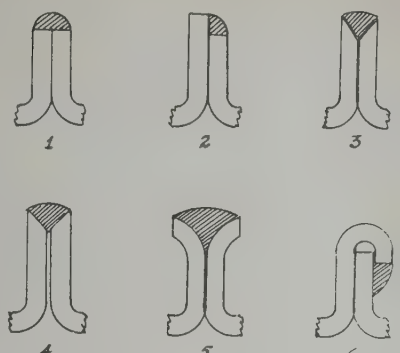


Fig. 9.—Types of Flange Weld. No. 6 Is Particularly Suited for Electric-Arc Welding

The American Water Meter Institute Organized

After several discussions among interested parties, whose names are given herein, an association to be called The American Water Meter Institute has been organized, and at a meeting held at the Engineers Club of New York City on May 22nd, immediate organization being agreed upon, officers were elected and committees appointed, and the following definite aims and objects of the Institute are set forth for the information of the trade, the public and the members' own organizations, and were signed by an executive of each of the subscribing members whose names are given below.

The American Water Meter Institute has been organized by manufacturers of water meters for the purpose of co-operation with customers and all others who are interested in promoting the welfare of the water works industry.

Any manufacturer of water meters whose business is conducted principally in the United States is eligible to membership.

The purpose of this Institute are mainly as follows:

1. To eliminate practices and methods detrimental to the entire water works industry.
2. To work for the further acceptance of the present "Standard Specifications," so that the members of the Institute may be protected against unnecessary changes in formulae of materials or changes in design and construction, unless and until such changes are warranted by the progress or the needs of the industry, and to eliminate unreasonable specifications and guarantees.
3. To promote open discussion of trade conditions and to bring about a clearer understanding of the problems of the manufacturer, vendor and consumer.
4. To act jointly on such problems as freight rates, exhibits, attendance at conventions, and such other matters as affect the industry.
5. To promote the use of water meters wherever possible and to make a concerted effort to show the public in general and publicly owned water works' officials in particular, that the use of water meters is desirable because it prevents waste of our natural resources, reduces taxes, and promotes public health and welfare.

The Institute will seek definite approval for its work from the Federal Trade Commission.

The above outlines the objects of the Institute, which will welcome the co-operation of other associations having kindred aims for the general promotion of the water meter business.

The officers elected for the ensuing year at the meeting of May 22nd were:

W. F. Rockwell, President.

J. B. Kirkpatrick, Vice-President.

R. S. Bassett, Secretary and Treasurer.

and the following companies, through their executives, have taken membership in the Institute:

Badger Meter Manufacturing Co.
Buffalo Meter Co.
Federal Meter Corp.
Gamon Meter Company.
Hersey Manufacturing Co.
National Meter Co.
Neptune Meter Co.
Pittsburgh-Equitable Meter Co.
Union Water Meter Co.
Worthington Pump and Machinery Corp.

New York City Has Air Engineer.—Clarence Chamberlain has been appointed consultant on the construction of the municipal airport of New York City at Barren Island. The appointment carries with it the title of Aeronautic engineer and a salary of $1,000 per month.

How to Get Public Cooperation in Keeping Street Clean.—A paramount fact which must not be lost sight of in seeking the cooperation of the public is that there is nothing which encourages carefulness upon the part of the public so much as efficient and careful cleaning by the Department. One does not hesitate to throw paper or rubbish onto an untidy street, but would think twice if the street were clean.—George W. Dies, Street Commissioner of Toronto, Ont., in his annual report for 1927.

Motor Sweeper Picks up Leaves.—A novel idea at Flint, Mich., is the use of a motor sweeper to pick up leaves from the parkway strip. Residents are requested to rake their leaves to the edge of the curb just before the street is cleaned, and the sweeper brush is raised several inches to pick them up.

Desirable and Reasonable Traffic Regulations For General Use

An Outline of the Details of General Traffic Control

By E. W. JAMES
Chief Divison of Design, U. S. Bureau of Public Roads, Washington, D. C.

IN the course of the last ten years the civil engineer who has made highway work his specialty has found that a new phase of highway activity has been rapidly growing in importance. We were formerly concerned with highway construction and maintenance; we are now concerned with highway construction, maintenance and operation, and by no means the least of these activities is highway operation. While highway transport is acquiring more and more the characteristics of railroad transport in many of its aspects, highway transport is characterized by, and must be protected in, retaining the element of flexibility which makes it of such outstanding importance. We have a relatively high-powered vehicle which does not operate on individual trackage. We place at the throttle of this vehicle any person with ordinary intelligence. The manufacturer is constantly striving to widen his market, and cheapen the equipment to a point where it will be available to smaller and smaller incomes and a constantly extending use.

The automobile is rapidly becoming an expression of American life. Freedom of movement, like freedom of speech, freedom of the press and freedom of worship are fundamentals of American liberty, and the outstanding instrumentality of freedom of movement in America today is the individual automobile and the commercial truck. Thirty years ago, when our automobile registration was 4,600, we were figuratively still sitting at the feet of the French road builder, taking lessons in the testing of materials, the drafting of specifications and methods of construction, and no state in the Union had an improved highway entirely across it in any direction. Since then we have become the foremost road-building nation of the world, and our progress in the science and art of highway construction has been so great that today all the world is turning to the United States for ideas and guidance in the expansion of their own older highway systems. The automobile industry has grown until it has produced in excess of 4,000,000 vehicles in a single year, to accommodate which on a 15-ft. headway would require over 21,000 miles of highway. To construct, maintain and operate highways under such pressure is a matter of the greatest national urgency. With respect to the operation, with which we are particularly concerned, our problem is twofold,—to make adequate provision for what we have in the way of transport, and to take preventive measures against a national jamb in the future.

If funds are forthcoming, the highway engineer can take care of construction and maintenance. The highway-building industry is today equipped to take care of any probable emergency in this direction. The serious problem lies in the field of operation. As conditions exist it is more dangerous today to drive a car than it is to have typhoid or diphtheria or both, and to drive a car for ten years is more dangerous than to be called upon once in ten years to serve in an expeditionary force in a great foreign war. In the last ten years we have lost by death in automobile accidents about 30,000 more than the entire losses in battle, by disease, suicide or accident during the period the United States was engaged in the World War.

The railroads have found it necessary to establish elaborate and exact operating regulations. Railroad engine drivers are highly skilled men of mature years, physical soundness and having good judgment. Our great problem is to establish an equally efficient set of operating rules, applying them to the drivers of automobiles and trucks, and do this in a manner which will not destroy the outstanding advantage of motor transport which is its great flexibility.

I submit to you two fundamental principles which I think must apply in such an effort; these are the rule of uniformity and the rule of reason.

Rule of Uniformity.—I believe the first rule is generally accepted. We have had the Hoover conference on street and highway safety prompted solely by an effort to induce unified action by the several States in all matters pertaining to highway traffic, including traffic regulations. Out of this conference has grown the Committee on Municipal Traffic Regulations, which is now actively engaged in formulating the details for the regulation of traffic in municipalities. The Association of State Highway Officials has undertaken to promulgate a uniformity of highway marking, including a variety of caution and danger signs. As all of this work has progressed it was found that there existed so great a variety of regulations, rules on the road, and methods of conveying instructions as to amount almost to a chaotic condition. In the three and a half years since the meeting of the first conference on street and highway safety there has been a decided change for the better, but much remains to be done. The immediate accomplishment has been the general acceptance of the rule of uniformity. When a man can drive in any city or in any State with the same confident familiarity with driving requirements that he possesses with respect to his own community, I believe much will have been done to reduce the needless stream of accidents that now flows along with our highway traffic. In admitting that the application of this fundamental rule is difficult and will be slow, I speak from a full and wide experience, but past performance is encouraging, and I believe that we may look for the relinquishment of pet ideas, of the desire to be different, and of the tendency to enforce unique restrictions, and for the ultimate adoption of regulations which may be everywhere communicated in approximately the same form and enforced in essentially the same way.

Rule of Reason.—The rule of reason does not yet occupy so sound a place in our public handling of traffic problems. This always characterizes the rule of reason when applied to any activity. Devising a test of reasonableness is the very first difficulty. Shall we, for instance, base our test of reasonableness on speed or on congestion? In order to avoid the latter, shall we throw down the bars to speed? In order to avoid speed shall we aggravate congestion?

In the last three or four years there has been a pronounced tendency in State traffic laws and local regulations to permit, or even encourage, high speeds. On the other hand, some investigators have shown that a traffic lane will deliver per hour more vehicles operating under safe conditions and at a speed of 15 miles an hour than at any higher speed. In some cases the whole question is dodged by an effort to control reckless driving only, whether this is required in speed or in handling the car. I am of the opinion that a substantial per cent of our accidents today are the result of overspeeding with respect to the conditions existing. We can imagine congestion, but it is diffi-

cult to imagine a serious automobile accident if all cars were operating at six miles an hour. The fact that 63 per cent of the accidents in Connecticut occur on good road surfaces, that 59 per cent occur in daylight, that 78 per cent occur in clear weather, that 38 per cent occur on a clear course, and the further significant fact that the rate per one thousand accidents for drivers under twenty years of age is three times that of drivers over thirty and four times that of drivers over fifty confirms me in this opinion. This is further supported by the fact that the driver is considered to blame in 74 per cent of all cases.

The adjustment to be made in determining the rule of reason as applying to speed and congestion is to fix after adequate study what will reduce congestion to the lowest amount obtainable with the greatest safety. If this results in relative congestion on our streets and highways, then the remedy is other routes or wider routes. This is the sound way to take care of all conditions which exist, and indicates the preventive measures for the future to which I have already referred.

Results of Surveys at Cleveland.—Recent surveys have been made in the vicinity of Cleveland, O., and in the city, where there exists on different routes a great variety of traffic, and where there is at some points an excessive and annoying congestion. A space-time recording apparatus was used for determining changes in speed and distances covered. A careful census of total traffic was made on all the routes studied. In operating the test car, carrying the space-time recorder, the experiment required that the operator put the car into the stream of traffic and keep it there as nearly as possible in coincidence with the general flow of vehicles. If one car passed him, he was instructed to pass one car, thus retaining his relative position in the line of traffic, but he was not to weave about with the purpose of gaining advantage in position so that he might increase his speed. He deliberately operated with the general flow of traffic. A recorder kept notes of events during the run, and the figures which I have to submit are those which were produced where conditions of congestion were just avoided. It was found that where the traffic on a 2-lane road was at the rate of 3,000 per day (twenty-four hours) an average speed of 36 miles was possible. With 4,000 traffic per day a speed of 34 miles was attained; with 7,250 a speed of 25 miles was recorded. On a road which was unnecessarily wide for two lanes, but hardly qualified as a 3-lane road because of parking conditions, a daily traffic of 8,500 vehicles permitted a speed of 28 miles, and a daily traffic of 12,250 a speed of 24 miles. If this is considered a 3-lane road it will be seen that these values fit in exactly with the previous figures for a 2-lane road on the basis of traffic per lane. On a 4-lane route the the following conditions were observed: When 12,000 vehicles per day were passing, a speed of 29 miles was possible; with 17,000 vehicles the necessary speed dropped to 28 miles; with 29,000 vehicles the speed was 24 miles an hour; and with 32,000 the speed was 23½ miles per hour.

Studies were made on other routes with somewhat greater refinement with respect to the traffic census. On a certain 6-lane road with 1,300 vehicles per hour a speed of 16 miles was attained; with a traffic of 1,700 per hour a speed of 14 miles was indicated by the tests. A similar more refined study on a 4-lane route covering 1,300 per hour indicated a speed of 16 miles per hour, and one covering 1,500 per hour the speed was forced down to 9 miles. These studies, while indicating higher speeds for the most part than those resulting from a mathematical study such as that made by Dean A. N. Johnson, clearly show, nevertheless, that a given traveled way will carry more vehicles at a lower speed under average conditions of operation.

The accidents reported in the city of Cleveland and shown on a spot map indicates that along the routes where the above figures have been secured the relative safety of driving is what may be referred to as normal or average. With the speeds and the traffic indicated the rate of accidents per 1,000 vehicles was neither substantially above nor below the rate on other thoroughfares.

This still leaves us in doubt as to whether a further restriction of speed would or would not reduce the accidents on these particular routes, but the studies are reasonably conclusive that the speeds were not so low as to be the cause of congestion, inasmuch as the capacity of the routes was continuously increased down to the lowest speed indicated. The result of these particular studies, therefore, would appear to indicate that speeds above 20 or 25 miles per hour are not necessary to reduce congestion. If carefully coincident studies could be made to determine whether accidents on these particular routes or other routes similarly studied are at a greater rate for higher speeds, it will probably be possible to fix upon a reasonable speed which will reduce accidents to a minimum and at the same time cause no congestion and maintain the capacity of the route at as high a point as can be conceded to the demands for saving time. Whether a similar speed limit should be fixed for the open highway is a question which should receive further careful study along similar lines, and in coming to a conclusion it should be borne in mind that one of the purposes of present regulations is to prevent future traffic difficulties. It is therefore better to maintain relatively low speeds not absolutely required by route capacity at this time in order to avoid the necessity of re-educating the public to low speeds in the future after they are thoroughly accustomed to high speeds.

Red and Yellow Lights.—There are several other matters which are still in the debatable zone when we apply our rule of reason, and conspicuous among them is the use of red and yellow lights. Red is almost universally recognized on the highway as a stop light. The Association of State Highway Officials, however, has adopted a stop sign with a yellow background, and the question of red or yellow for automobile tail lights is still unsettled. It occurs to me that there is a rather nice distinction that can be made with respect to the use of red or yellow which may be stated somewhat as follows: red signifies to stop and to remain stopped until the signal changes or some other instruction is given to proceed; yellow signifies caution, and if a yellow sign instructs traffic to stop, it indicates that extreme caution is necessary and that traffic should stop, but may then proceed past the stop sign without change of signal or other instruction when the driver is assured that he may safely proceed. This formula appears to come nearer fitting all of the conditions logically than any other I have heard. It permits the continued use of red tail lights, red lanterns on fixed obstructions, and yellow boulevard stop signs where the intersection is not automatically or otherwise controlled.

Where control lights are operated at an intersection the color cycle also varies. According to present practices it is "Red-Yellow-Green-Yellow" in some cases, and "Red-Green-Yellow" in others. The use of the yellow interval between the red and green is in question. The present trend of opinion, however, appears to be in favor of the "Red-Green-Yellow" cycle, and the reason for this appears sound. On the open street the yellow should flash, while the red still shows on the closed street; then when the yellow goes off the red goes on the formerly open street; the green should at the same instant come on the formerly closed street. This sequence gives warning on the open street that the red is about to flash, and provides opportunity for the intersection to be cleared before the green goes on the intersecting route.

Pavement Markings.—There is a growing tendency to use pavement markings, and a word should be said regarding more particularly the use of the continuous white line. It appears desirable that the continuous white line should be used only where it should never be crossed. This is a simple rule which the public can easily learn even if they disregard it in practice. Such a white line is the best possible witness in case of an accident. The man whose car is on the wrong side of such a line has no justification whatever. If such continuous lines are used where they may be crossed and where they may not be crossed confusion will always exist in the minds of drivers. Practice in

the use of the continuous white lines is gradually crystallizing for the following uses:

(a) Centerline on a curve having a radius of less than 600 ft.
(b) Centerline on a grade steeper than 6 per cent.
(c) Centerline on vertical curves where the clear sight distance is less than 500 ft.
(d) Traffic lanes on streets wide enough for three or more lanes, where direct approach to certain critical areas is necessary.
(e) Street-car landing areas.

Where white lines are considered necessary to indicate the boundary of pedestrian cross-walks, of vehicle turning limits at street intersections, at street-car clearance limits at turning points, or to indicate parking space, broken lines should be used.

Considerable difference of opinion still exists with respect to the time and method of making left and right turns at controlled intersections. Left turns are sometimes made on the outside of the intersection; sometimes closely around the center of the intersection. Right-hand turns are sometimes permitted and sometimes not permitted against the red light on the closed street. These two sets of conditions must be handled together.

In the first place, if we are to adhere to the significance of the red light, a right turn should not be made against it. If this is established, then the left turn at the center of the intersection will tend to obstruct traffic more or less seriously whenever vehicles waiting the right turn are standing close to the intersection. Therefore, if right turns against the red light are prohibited, left turns should be made on the outside of the intersection. This relation appears to be the soundest solution. It can be used on both wide and narrow streets where control is automatic or by police direction, and it throws all vehicles waiting both the left and the right turn over to the extreme right-hand side of the approaching street and intersection. Any other combination appears to have some greater disadvantages.

I have confined myself to those details of general traffic control which are at the present time most in dispute. Other details which are subject to a variety of adjustment are controlled by local situations existing. For instance, the one-way street has its supporters and its opponents, but after all it is a matter of the physical routing of traffic rather than a rule of the road. The parking question is a very serious one and widely and vigorously disputed, but it is a purely local question in every instance, and often it is local to individual streets or to blocks in a single street.

Such questions, however, are of the greatest significance in pointing the way toward those preventive measures which must be seriously considered if we are to meet future conditions which now appear probable. These preventive measures have very wide ramifications. They involve not only the question of routing and of parking space, but the details of highway and street design, and ultimately of city and regional planning. In all of these directions some work is being done, but we are not yet ready to draw definite conclusions with respect to many of the details. Highway engineers are perhaps more nearly in agreement on details of design to accommodate traffic than traffic directors are with respect to one-way streets or the parking privilege. And those devoted to city and regional planning are carefully studying the questions of building height and capacity, street layouts, decentralization, and the segregation and grouping of various business activities. All of these matters are involved in preventive measures for the future, which will make possible the continuation of urban growth and development without burdening such communities with exorbitant expenditures to overcome chaotic and impossible traffic conditions.

Specifically, at this time we are in need of information regarding the traffic density on 2, 3 or 4 lane intersections when automatic signals should be introduced, and the further point in traffic density when police control should be adopted. There are still to be found many who believe that traffic moves more rapidly and even more safely when it is permitted to make its own way through intersections. Undoubtedly traffic control has been installed where not needed. This is because we do not know for any given case what the critical points of capacity are. This should be studied.

Further studies should be made regarding the increased efficiency of a highway due to the introduction of rotary intersections or grade-crossing separations. Theoretically a grade-crossing separation should give us an increased efficiency of at least 50 per cent. It is probably more than that. Such a large saving may warrant the expenditure of much greater sums for this kind of work than we have believed justifiable heretofore.

Studies regarding the detailed design of rotary intersections are imperatively necessary at once. The Bureau of Public Roads is now considering a rather wide study of this last matter, and it may be expected that within a reasonable time some data much more valuable than any now available will be in hand.

The use of this material is going to be necessary in the near future, for it requires but little imagination to picture the impossible condition which will result if we depend entirely on methods of immediate control for the solution of all possible traffic problems, and reject those preventive measures which promise so great an advantage for the future.

Acknowledgment.—The foregoing is a paper presented April 18 before the Affiliated Technical Societies of Boston.

Proceedings Texas Water Works School

Procedings of the Tenth Texas Water Works School, distributed by the Texas Section of the Southwest Water Works Association at $1.00 per copy, E. G. Eggert, treasurer, Austin, Tex. On lots of ten or more copies 40 per cent discount is allowed.

The volume is divided into two sections, one devoted to water and the other to sewerage and covers 294 pages. The two subjects are rather fully gone into considering that the material was prepared for a four-day program which had to represent the varied interests of the water and sewerage plant operators in Texas. The papers were prepared by some of the foremost men in their respective fields in America and foreign countries.

H. W. Streeter of the U. S. Public Health Service discusses filter plant loading and stream pollution; microscopic life in water is treated by Dr. Asa Chandler of the Rice Institute, Houston, Texas; Dr. Karl Imhoff tells how he calculates the capacity of sludge digestion tanks; Arthur J. Martin, consulting engineer of London, discusses activated sludge problems from the English standpoint, while G. L. Fugate and J. C. McVea, engineers of Houston, Texas, disclose some of the secrets of a successful activiated sludge plant in Texas as exhibited by the Houston installation. Dr. Willem Rudolfs of New Jersey Experiment Station fame points the way toward a comprehensive sewage research program for Texas.

The special water problems of Waco and St. Louis are discussed by a water superintendent and a water commissioner, respectively, who have had charge of their plants for a number of years. While some of the recently installed and especially interesting sewage plants are described and illustrated, including that at Fort Worth, Houston, Jacksonville and Waco.

Cost of Street Cleaning at Washington, D. C.

The following table from the report of the operations of the engineer department of the District of Columbia shows the unit cost of street cleaning for the fiscal year July 1, 1926, to June 30, 1927:

	Area, square yards	Cost per 1,000 sq. yd.
Horse sweepers	70,843,000	$0.319
Hand sweepers	60,126,000	.176
Alley cleaning	103,250,000	.571
Suburban cleaning	57,831,000	.447
Hand patrol	1,739,011,000	.122
Motor flushing	705,056,000	.0714

Uniform Accounting Systems for Water Works

Paper Read at 1928 Convention of American Water Works Association

By R. B. F. CHISHOLM
Secretary, California Water Service Co., San Francisco, Calif.

ACCOUNTING may be defined generally as a procedure relating to the assembly and recording of facts in business transactions in an orderly, chronological manner, so that periodical statements may be rendered, showing the financial position of any business enterprise and the results from operation; and may be considered as the right hand of management or administration.

Accounting embraces a large field:
General Accounting.
Plant Accounting.
Cost Accounting.
Stores Accounting.
Revenue Accounting.
Budgeting.
Accounting Systems.
Systems of Internal Check.
Statistical Information.
Payroll Accounting.
Expense Accounting.

Accounting for Capital Stock and Dividends, etc.

Accounting is based on theory as well as fact. Theories or mental speculations, as they may be called, after having been tested by long usage, have become established as principles, which in the accounting field become known as principles of accounting. However, accounting principles are subject to development, evolution and change, so that principles laid down in the past must not be considered as iron-clad, but as subject to continuous improvement. Each and every business problem must be solved by the accountant, not on the basis of an accounting formula, not on the basis of precedents relating to methods adopted by others, but on that of the conditions prevailing and of the objectives to be accomplished in each case.

When we speak then of uniform accounting for our own field, we must keep the above thoughts in mind and realize that often local conditions, local policies, etc., must be considered and to some extent may require modifications of any principles of uniform accounting which we may endeavor to lay down at this or any other time.

Uniform Accounting.—Uniform accounting for water utilities can best be expressed through uniform classifications of accounts, but uniform classifications of accounts do not necessarily result in uniform accounting as different accounts may classify items under entirely different heads. For example:

Overhead expense, such as salaries of officials, general management and supervisory costs are absorbed by some companies entirely in expense and others allocate same on a basis of construction and operating expense. Accurate application of these expenses is very essential so that neither construction nor operation will be burdened unduly.

Where a utility charges a large part of its overhead to construction, the fixed capital account is, of course, increased and the operating expenses are reduced to a minimum. Such a practice might result in a reduction of rates by public utility commissions. On the other hand, if operations are charged with a large overhead, which should apply to construction, then the commission would probably allow a very small overhead on the property with the result that a large return may be earned on less than its true cost. Utility companies should endeavor to allocate these overheads to both construction and operation on the basis of actual work performed. This would also apply where a utility handles gas and electric or water, the overhead costs being distributed on as nearly an equitable basis as possible to the actual cost of each department.

This procedure, as we all know, is on the basis that even though aside from the importance of having records prepared and kept correctly that it is preferable to earn on expenditures over a long period of years that should be capitalized rather than getting such items allowed as expenses for that particular year only.

The wages of construction foremen and other supervision of labor should be handled as direct labor costs and not included in the overhead expense. It is desirable that the accounting policy in connection with the cost of engineering and general supervision work for construction should be followed as closely as possible with the practices of valuation engineers in setting out the cost of engineering and supervision, apart from the unit cost of labor and materials charged directly.

Construction should also be charged with reasonable proportion of legal expenses, compensation insurance, public liability insurance, taxes, and also interest on the money expended during the period of construction. Various methods are in use in determining these ratios and some utilities consider these items as direct charges, while others include them in overhead.

Indirect expenses, such as purchasing, stores, etc., may be absorbed in the case of overhead expense in operation or allocated properly to construction and operation.

We consider that the cost of purchasing supplies, handling of stores and small items of freight and hauling are properly chargeable to the unit of cost of the material. It appears to me that the most logical way to handle these expenses is to allocate them on the basis of the cost of materials used on construction and operation. Some companies follow the practice of charging out materials at the actual cost as shown by the stock cards, but I believe that the simpler method of withdrawing materials from stock is to use the average cost system.

Minor replacements or repairs are absorbed by some companies entirely in expense and by others absorbed partially, at least, in depreciation reserve. We have followed the policy in the case of replacements of retiring the original capital in full and making the proper entries to depreciation reserve, the cost of removing being charged to operation.

One matter which has been discussed to a considerable extent by the officials of our company is that of paving over mains, which necessitates the raising or lowering of mains, which is ordered by a municipality, but for which the company has to stand the expense. Many utilities charge the entire cost of this work to operation even though the location of the mains may be changed; but we have followed the policy of retiring from capital the original cost of labor and material laying these mains, making the proper entries to depreciation reserve and charging into capital the cost of opening up the ditch, back-filling and paving and where the material was retired at a salvage value, this same value would be charged back to capital, when used in connection with construction.

Officers' salaries are classified by some companies in general expense, while others allocate these salaries to the various classified superintendence accounts. We have considered them as general expense, but distributed over our districts on the basis of gross revenue.

Any differences such as above would, of course, make comparison between various companies of little use.

Desirability of Uniform Accounting.—Uniform accounting classifications and procedures, in spite of the above mentioned difficulties, are undoubtedly desirable, at least as an ideal to strive towards for the following reasons:

Permits comparisons of financial position, operating results, etc., to be readily made between water companies.

Results in application of Federal Income Tax on a uniform basis between all companies.

Valuable to the investor in water companies securities, as financial statements prepared for circulars would be prepared on the same basis. In other words, the investor would be furnished with net earnings statements, etc., based substantially on the same accounting procedures, so that he could rely on the statement of earning capacity in relation to interest or dividend charges as being comparable between water companies all over the country.

Valuable to the consumer as he could be brought to realize that there would be less opportunity for discrimination in rates between water users of different communities due to the fact that the basis for ascertaining the return on the rate base would be similar.

Advantages to regulatory bodies. Most utility commissions have been given the regulation and control of utilities operations and many commissions require utility ocmpanies to keep their accounts and records in a manner prescribed by them. This control is exercised largely through accounting records, reports and procedures and these commissions are dependent to a great extent on the soundness of the accounting principles of companies under their jurisdiction.

Problems to Be Considered.—Adoption of a uniform classification of accounts by State Public Utility Commissions throughout the country. The National Association of Railway and Utilities Commissioners have provided a uniform classification of accounts which were revised November, 1922, and goes into the matter of utility accounting in a very comprehensive manner, and up to 1925 a total of 25 states have adopted completely, or nearly so, this uniform classification. Nine commissions have no jurisdiction over this accounting; one has adopted the Federal Power Commission's classification and twelve more have the classification under consideration.

Value of Uniform Classification of Accounts.—One of the principal advantages of uniform accounting is that proper comparisons could be made in financial statements and where a holding company has interests in many states, it is very evident that a uniform classification is desirable. The California Water Service Company reports to the Federal Water Service Corporation of New York under the National Association of Railway and Utilities Classification, while our accounts and records are carried under the California classification of Accounts as prescribed by the Commission. If the California Commission could be persuaded to adopt the National Association Classification, it would, of course, result in considerable saving to our Company.

Centralized Accounting.—This is a matter that should be considered very seriously by public utilities and as an example, I will briefly state the system which our company has adopted in this regard. We are operating twenty-two companies in California and by adoption of centralized accounting, we are enabled to properly classify accounts, to employ less expensive help in the outside districts, close our books earlier, and for the purpose of auditing or investigation by utility commissions, all original records remain in the General Office. This means that the General Office receives daily all Time Cards, Withdrawals of Stores Tags, Auto Mileage Reports, Bank Deposits, etc. As these reports are received by the General Office, they are checked and tabulated and at the end of the month we have only one or two days reports to enter.

In a large organization or even in organizations consisting of more than two or three separate properties, proper accounting control is absolutely essential for efficient and economical management.

Another feature of centralized accounting is the matter of employing specialized help. It has been proven that specialization in every case gives greater efficiency at a reduced cost.

Under the system of employing an accountant in each company or district, we have found that the interpretation of accounts differed to such an extent that departmental costs were entirely out of proportion. For instance, some accountants might consider rent, stationery and printing in the commercial department as a general expense, while others would consider it as a part of the commercial department. Centralized accounting eliminates these discrepancies and gives us a true analysis of these expenses over the various districts and the management is thereby enabled to place its finger on the companies or districts which are not operating efficiently.

The problem of educating the man in the field is extremely difficult, but with the adoption of centralized accounting and the use of accountants specialized in the study of classifications, we have eliminated our trouble in this respect.

Consumers Billing.—A great deal has been said as to the successful operation of the stub system of billing, but I believe that the stub system has been developed to such an extent that there is no longer any doubt in the minds of large utilities but that it is the most economical and successful method. Our company is preparing at the present time to adopt a stub plan, using a Government Post Card for mailing to the consumers. This alone reduces the postage to one-half, besides saving in the purchasing of envelopes. We have approximately 85,000 consumers and in postage, labor stuffing envelopes and the cost of envelopes themselves, we expect to save $20,000 per year.

Stores Accounting.—The method of handling the Stores Department varies considerably in utility companies, but proper stores accounting is essential to adequate control of materials and supplies.

A definite assignment of responsibilities for stores accounting activities is, of course, necessary if proper control is to be obtained. This is a very large subject and it appears to me that a uniform method of handling stores would be of very great benefit to public utilities.

We have adopted centralized stores accounting and we are thereby enabled, from the General Office, to analyze the quantities of materials and supplies on hand at any station, transfer any overstock from one station to another, keep accurate records of obsolete materials or junk, check up on slow moving material and see that proper credits are made to plant in the case of retirements.

We use accounting machines in this department and all pricing, posting of materials and withdrawals from stock, figuring average costs and balancing is done on two machines for twenty-two companies.

Machine Bookkeeping.—The introduction of bookkeeping machines into general accounting has, I believe, made very satisfactory progress, especially where the company has a large volume of calculations and the work can be concentrated into the hands of one or two machine operators, the result being that production will be higher and the unit cost much lower. This will also leave the more expensive help to carry out more important duties.

I have seen the bookkeeping machines used on public utility general ledger work, journalizing, cash books, daily cash statements, bank registers, capital stock records, stock sold on the installment plan and payroll work. The important result of machine operation is that the books of account are in balance at all times and the matter of taking off a trial balance is very simple.

Depreciation.—The matter of depreciation of plant should be considered very fully by the Association for the reason that there is no uniform method. At the present time, it is impossible to lay down any specific rates of depreciation which will have any absolute value for the reason that conditions under which equipment is used varies so much that no uniform rate could reasonably be determined for all utilities.

When we consider the number of methods used, i. e., annual apportionment of depreciation, straight line method, depreciation after percentage of diminishing value, annuity method and sinking fund basis, it is very obvious that a uniform system would be of great advantage. It must be remembered, however, that there are advantages and disadvantages in any system, and while the straight line method is more generally used on account of its simplicity, it may be conceded that the sinking fund method is the better. This system, however, is expensive, and would necessarily mean that uniform lives would have to be allotted to the various classes of fixed capital and very complete plant records set up, so that in retiring capital, the proper life of the plant involved could be determined.

It should also be borne in mind that in adjusting rates, most utility commissions go into the matter of depreciation very fully and many utilities have had to appropriate considerable money from their surplus to make up the depreciation reserve which the commission considered necessary.

In addition to the loss from wear and tear, equipment is subject to further depreciation from economic changes. Experience may show that on the average, certain equipment would be serviceable for twenty years, but becomes obsolete in one-half that time on account of new inventions and although the equipment itself might be in very fair condition, it would probably pay the utility to replace it with the improved type. A definite allowance, therefore, should be made for obsolescence and such an allowance will be recognized by the Internal Revenue Department.

Cost Accounting.—This is a subject that has not received a great deal of consideration from most utilities, but I believe that utilities are coming to realize the importance of keeping adequate cost records.

The principles and practices of cost accounting must be adopted to the utility business in order that companies may analyze their construction costs and properly record them in fixed capital accounts. The management should also be advised as to what construction work is costing and this can only be done with adequate cost records.

This Association could co-operate with the National Association of Cost Accountants towards the adoption of some uniform system.

Budgeting.—It is very important that utilities provide adequate budget control not only for capital expenditures, but also for maintenance and operating expense so that the proper co-ordination be maintained between the amount of capital going into industry and the use of such capital in construction programs.

In the utility business a budget is essential as a statement of future operating and extension plans, financial program, summary of appropriations and a standard for the measurement of performance.

Purposes of the Budget.—To define executive policies as to future operations.

To promote co-operation in the execution of policies and plans.

To prescribe the limits into which expenditures are to be confined.

To determine what funds will be required and when, so that they may be provided in a reasonable and orderly manner and at a minimum cost.

To set up standards by which accomplishment may be judged.

The companies using budgets most successfully are those in which the line and staff have had their part in the preparation of the estimates necessary for the construction of the budget and since budgets set forth a complete plan, every division of the company should be represented in the preparation of the estimates.

The preparation of a budget should be under the direction of an officer of the company who is intimately familiar with the affairs of the company and of utility operations in general. He should understand accounting, financial and operating problems thoroughly and be familiar with the functions of all the departments of the business.

The accounting staff is the logical one to handle the accumulation of budget data, since they are the most familiar with the cost of previous operations of the company. As a budget must be based on the operations of the past, it is desirable that the accumulation of these data be placed in the hands of those who are most familiar with it.

The preparation of a budget should be in considerable detail and given a specific number so that when the approval is given for expenditure of money, a reference can be made to the budget number and the final cost of the work for expenditure involved should tie in closely with the figure on the budget. For example, we might have an item in the budget for the building of a reservoir which would bear a certain budget number and when the authorization is given for the actual expenditure of the money, the budget reference should be shown on the authorization, so that when the work is finally completed, a check can be made against the estimated cost.

This is another phase of the business which would benefit greatly by uniform accounting.

Rates Paid by Large Cities for Water for Municipal Purposes

The following information on the above subject is taken from a report compiled by the Municipal Reference Division of the Seattle Public Library for the Water Department of Seattle, Wash. Questionnaires were sent to the 33 cities of over 200,000 population in this country.

Rates Paid by Cities for Water for Municipal Purposes. — The following cities report some payment from the city:

Akron. "Small amount annually."

Buffalo. Four cents per 1,000 gal. (1924 information). No hydrant rental.

Denver. "Some departments supplied free, others at reduced rates."

Indianapolis (private company). Rate not given. Water for hydrants supplied on inch-foot basis with nominal annual rental.

Milwaukee. Regular rates. Hydrant rental $10 per year per hydrant.

Minneapolis. Free water for general city service. Parks and libraries pay 4 ct. per 100 gal.

Oakland (private company). Regular rates for metered service. Public use charge based on number of feet of streets piped and number of hydrants: $10 to $50 per year per 1,000 ft. piped according to size of main, and $8 to $10 per hydrant per year if owned by the company, or $3 to $5 if owned by city. Basic charge for public use in 1917 was $105,500.

Omaha. No charge for city buildings or for flushing streets. All water used for sanitary sewer system in excess of 50,000 gal. per flush tank per month charged for at regular rates. Hydrants $60 per year.

Philadelphia. Schools and charitable institutions, 6 ct. per 1,000 cu. ft.

Pittsburgh. Public buildings at hotel rates. Charitable institutions and schools have free allowance, then 7 ct. per 1,000 gal. (1924 information).

Portland. $75,000 per year.

Providence. Most municipal supplies pay regular rates. No hydrant charge (1924 information).

Rochester. $150,000 per year.

St. Louis. Schools and libraries, 6 ct. per 100 cu. ft. Charitable institutions 4½ ct. per 100 cubic feet. No hydrant charge.

St. Paul. Regular rates. Hydrant charge $14 per year per hydrant.

San Francisco (private company). Regular rates. Hydrants, $5 per month per hydrant.

Seattle. For flushing streets, $14,400; for hydrants, $9 per year per hydrant.

The remaining cities considered in the compilation report no charge for water supplied for municipal purposes.

Jersey City has a book charge of $75,000 a year. In Detroit hydrants are furnished and maintained by the Fire Department. No recent information has been received for Atlanta, Boston, Jersey City or New Orleans. These cities in 1924 reported free water.

No information is available for Baltimore.

What They Think of an Engineer for President

Editorial Comment on Nomination of Hoover

THE DAILY NEWS, Chicago:

For the first time in the history of the United States a great national party has nominated for chief magistrate of the republic a distinguished engineer and an internationally famous administrator. This is not wholly accidental, being in truth significant of the trend of modern thought and of the increasing public demand for constructive ability and scientific leadership in politics, legislation and diplomacy. . . . The nature of the problems now confronting the United States has created a demand among men of affairs for the objective mind, which approaches public questions in a spirit of impartiality and which insists upon knowledge and certainty as preliminaries to important action. . . . The republican national convention has nominated for president a strong and able man, a man essentially open-minded and constructive, a man of vision and wide experience. Whether his passion for efficiency has removed him in any degree from the plane on which best can be understood the trials and aspirations of the common man is for the American people to judge in the coming political campaign. Apparently he is the true and lawful heir of the Coolidge policies.

THE OREGONIAN, Portland, Ore.:

Hoover is well equipped to deal with domestic problems. He knows from his work as food administrator the basic facts about agriculture and his titanic struggle in the early months of 1919 to save the American farmer from ruin by saving Europe from famine is abundant proof of his sympathy with the farmer. That sympathy, joined with his knowledge of economic law, is assurance that he will find a plan to dispose of surplus crops without resort to economic quackery. The Government has entered upon a number of construction projects so vast as to require at its head a man with the ability of a chief engineer. Hoover is such a man.

THE VINDICATOR, Youngstown, O.:

In nominating Herbert Hoover for president the Republicans have chosen their best man. . . . Hoover is the country's great administrator. We have come to look to him for everything from directing Mississippi relief to reducing the number of radio stations, and from finding foreign markets for our products to standardizing the sizes of blankets and lumber and paving bricks. It is his business in life to eliminate waste and promote efficiency. If he is elected president we shall see the movement to make industry more productive carried to its logical conclusion. Washington will be filled with conferences of all kinds, in which men and women from every nook and corner of the country will meet to try and find better ways of doing things. A great administrator, a great organizer, Hoover would be a great engineering president. He would work to improve things, not in the interests of capital or of labor, but for the sake of doing the job better, of doing it the best way men know how.

PLAIN DEALER, Cleveland, O.:

It is a circumstance which invites new confidence in democratic government when a great party turns to a man like Herbert C. Hoover and makes him its nominee for President. Whether he is elected or defeated in November, Hoover brings character and promise to the Republican ticket. He is a new kind of candidate in a day surfeited with old forms and old habits in politics. Hoover typifies efficiency. He thinks in terms of getting things done. To him government is an engineering problem, and like a master chess player he maneuvers his forces to the desired end.

THE TRIBUNE, Chicago:

The nomination of Herbert Hoover as Republican candidate for the presidency was given with a majority so impressive and with an enthusiasm so genuine and unforced that there is left no doubt it expressed the preponderant will of his party or that Mr. Hoover can go into action with the confidence in the authority of his leadership and the loyalty of his support. . . . Perhaps Mr. Hoover's main appeal to the judgment of the country rests upon his accomplishment in the gigantic task of war relief in Europe, a task of unprecedented scope and complicated difficulties, both administrative and diplomatic. In Belgium and western Europe, and later in center and eastern Europe, Mr. Hoover demonstrated executive genius of the first order. Returning to the United States, he has served with great ability in the administration of three Presidents, in various capacities, but most notably as secretary of commerce in the cabinets of Harding and Coolidge. His conduct of the department of commerce has been marked by initiative and creative energy. . . . For demonstrated executive ability, no candidate has ever sought the office of chief executive with greater justification.

THE STAR, Kansas City, Mo.:

In Herbert Hoover the Republican party has nominated a man with a remarkable training for the presidency. He has the background of working on the farm as a boy. He has had large business experience. He is an expert on foreign affairs. He has a passion for the big problems of an economic age. He has had ten years in Washington in contact with public questions, with congress, and with public men. He has administered a great government department. . . . There is the human side to Hoover that the country will learn as it becomes better acquainted with him.

POST-GAZETTE, Pittsburgh, Pa.:

Herbert Hoover has been nominated for the presidency of the United States at the Kansas City convention. . . . Mr. Hoover's marked ability has been demonstrated again and again in his long years of faithful service. His personal integrity and character are beyond question. In the light of his record as Secretary of Commerce in the administrations of President Harding and President Coolidge all citizens can rest confidently in the assurance that he will make a capable President.

DAILY JOURNAL, Elizabeth, N. J.:

The logical as well as the expected has happened in the nomination of Herbert Clark Hoover for President by the Republican party. Seldom, since the time of Lincoln, has the party made so good a choice. It has seized and firmly held one of the greater opportunities of its existence. It would be difficult in this time to find a man so consummately adapted to the occasion, and to the needs of the country. Herbert Hoover has long represented the most constructive of statesmanship in aggressive action and performance. The country, and the world at large, has turned to him to undertake great tasks. He has easily taken them upon his broad shoulders and performed them. He has a mind that plans work that is enduring. . . . The record of Herbert Hoover shows him not to be just a prominent American among prominent Americans; but a builder of American and world welfare, who stands as high as the highest. He has exhibited a positive genius for construction; and his character stands for moral construction, as his achievement has registered so greatly in solving the more material problems of the nation. He has a genius for serving human welfare; and that is the type of man who appeals to Americans in these reconstruction days. He is a man of boundless resources, as his record shows.

Layout Planning for Municipal Airports

Outline of Provisions Necessary for Effective Service

By CARL H. WOLFLEY

St. Joseph, Mo., Consulting Aeronautic Engineer; Chairman, Committee on Airports and Airways, National Aeronautic Association

WHEREVER permitted by state law, city authorities should own and operate the municipal airport. The Aero Board or Aviation Committee will be charged with the duty of securing the necessary engineering services for planning and laying out the airport. This layout should provide hard surface for landing and taking off, hangars, repair shop and service station, standard markers for the field and lighting, parking space for automobiles, taxis, and buses, and the usual utilities including water, sewers, gas, electricity and telephones. If not provided for elsewhere, the administration building should include passenger and express depot, a rest room, sleeping quarters for the personnel and pilots, restaurant, first aid facilities and provisions for weather bureau reports.

Size and Shape.—The size and shape of the field will be somewhat dependent on local conditions. Every city planning a first class airport will, however, have at least the space necessary for the layout such as shown in the accompanying sketch of the model airport. The area provided for future expansion will depend upon the city.

It may seem difficult to estimate the amount of air traffic to be provided for. At the present time several airports in the United States are handling about 1,200 planes a month. A few years ago a year's production of airplanes was small. This year the leading factories have more orders than they can fill and several thousand new planes will be put in service. From the point of view of the aviation industry, it is a conservative estimate to say that we can expect 5,000,000 planes in operation in this country at the end of the next ten or fifteen years. Even today, a first class airport should be equipped for planes landing or taking off every five or ten minutes. This does not mean, of course, that all construction must be completed in advance, but the plans should be so complete that additional buildings and runways may be readily added each year to serve the increased traffic.

Location of Buildings.—It is recommended that in the beginning all buildings be located along one side of the field in order to concentrate administration and service facilities. It may be necessary later to add one or more rows of additional buildings adjoining these, but locating the buildings on one side of the field leaves the entire field free for planes landing and taking off under favorable conditions without obstructions and also leaves the field free for expansion in three directions. The necessary buildings should be of permanent construction, fireproof and weatherproof. A conventional size for a hangar today is 100 ft. wide and 120 to 140 ft. long with 18-ft. clearance throughout the inside. A truss roof should be used. Reinforced concrete, cement block, stucco or other masonry material may be used for walls. Masonry walls are recommended in every location to assist in keeping the building warm in winter and cool in summer. A goodly amount of window area should be provided and skylights used where center lighting is desired. Concrete strips or ramps 100 ft. wide should extend along the front and sides of the hangars and connect with the runways. Modern service stations for oil and gasoline should be constructed. It is recommended that pipe lines lead in various directions to points on the field where the service of air, water and gasoline may be rendered from storage pits covered by trap doors. The general scheme for the buildings should give thought to an arrangement that will be attractive and dignified. A reasonable amount of space for flower beds and shrubs around the building is highly desirable. We are planning now for what will soon become one of our most important industries. Airports today are more in the public eye than any other municipal building, park or recreation center. They demand the same careful attention and details that our railway stations, city halls, and modern office buildings receive.

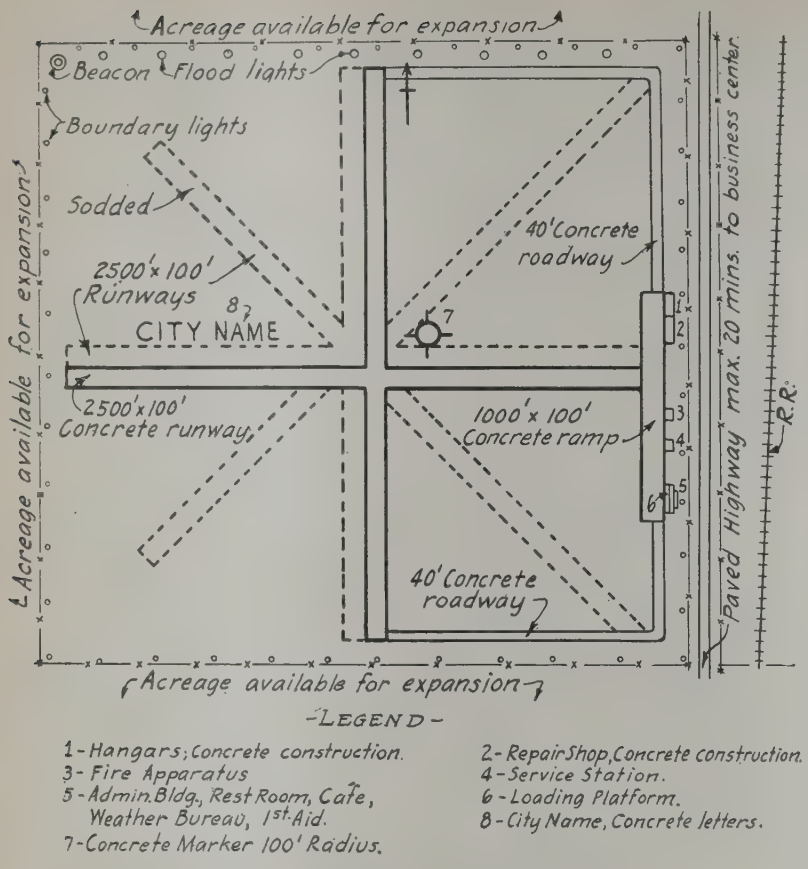
Runways.—The sketch of the model airport shows eight landing strips meeting at the center. Each pair has a minimum length of 2,500 ft. clear. Another layout might not show all of these intersecting, but the sketch shows the greatest economy in space where a landing strip is provided in every principal direction.

Very few fields are as fortunate as St. Joseph, Mo., having a naturally solid bearing surface and an all-over type of field signifying landing or tak-

PROPOSED RATING AND COMPARISON OF COMMERIAL AIR PORTS

ITEMS	CLASS				
	FIRST	SECOND	THIRD	FOURTH	FIFTH
1. No. of runways 200' wide or paved strips 100' wide - safe in all weather.	8	8	4	3	2
A. Total distance in clear each direction	3000	2500	2000	1500	1200
B. Capacity, planes per day.	500	500	250	150	100
2. Acreage and available for expansion	600	400	300	200	100
3. No. of Hangars 60'x 100'x 15' or larger	4	2	1	1	-
4- Repair Shop.	1	1	1	-	-
5- Service Station	1	1	1	1	-
6- Fire Apparatus	1	1	1	1	-
7- Administration Building	1	1	-	-	-
A Rest Room	1	1	-	-	-
B Passenger and Express Depot	1	1	1	-	-
C Sleeping Quarters	1	1	-	-	-
D Restaurant	1	1	-	-	-
E First Aid Facilities	1	1	1	-	-
F Register of Arrivals and Departures	1	1	1	-	-
G Weather Records and Reports	1	1	1	-	-
H Utilities - Sewers, Water, Gas, Electricity and Telephones	1	1	1	1	-
8- Improved Highways to Civic Center	1	1	1	1	1
A - Regular Transportation Service Day and Night	1	1	Day	Day	-
9- Railways Facilities - Siding Space	1	1	-	-	-
10- Automobile Parking Space - Cars	500	300	200	-	-
11- Lighting and Signals	1	1	1	-	-
A- Boundary Lights					
B- Flood Lights	1	1	1	-	-
C- Hangar Lights	1	1	-	-	-
D- Code Lights	1	1	-	-	-
E- Beacon Lights	1	1	-	-	-
F- Ceiling Projector	1	1	-	-	-
G- All Night Service	1	1	-	-	-
12- All Year Drainage System For Field	1	1	1	1	-
13- Standard Markers	1	1	1	1	1
A- Center Marker					
B- Wind Indicator	1	1	1	1	1
C- Magnetic Meridian	1	1	1	-	-
D- Station Name and Code No.	1	1	1	1	-
14- Adequate Seaplane Accommodations	1	1	1	1	1
A- Water Area Similar to Land Area					
B- Runways	2	1	-	-	-
C- Hangars	2	1	-	-	-
15- Accommodations for Dirigibles	1	1	1	-	-
A- Mooring Mast					
B- Hangar	1	1	-	-	-

Proposed Rating and Comparison of Commercial Air Ports



Drawing of a Suggested Layout for a Modern Airport

ing off in any direction. At St. Joseph, this consists of several feet of river sand thoroughly compacted over a long period of years. On most fields the surface needs drainage and usually underground piping to remove surface water as soon as possible after a storm. In the northern states an otherwise good field will be rough in winter when slight irregularities are frozen. In the long run, the cheapest construction to give hard, smooth surface in all weather and all seasons of the year is concrete for the runway surface. The natural surface adjoining should be seeded down with a grass that is suitable for the climate. In many cases bluegrass and clover will be best. It will take 12 or 14 months of good care to secure a permanent sod. Even with an all-over type of field at least two concrete runways affording 4-point landing and take-off are recommended. Concrete landing strips as shown will adjoin the natural runway.

Heavy Planes.—While many commercial planes today weigh from 5 to 7 tons, heavier weights must be expected. It is advisable that these runways be constructed to carry loads of at least 25 to 30 thousand pounds. Each concrete runway should be at least 100 ft. wide, although on fields of lesser importance it may be possible to get along for a few years with half this width. Concrete connections should be extended from the runways to the ramps and hangars. On some fields, runways have been constructed of cinders or surface treated stone or slag. As a business proposition, this construction cannot be recommended. Cinders are always dirty and, blown up by the wind from the propeller, may seriously damage the propeller or engine. Other light types of surfacing are expensive to maintain and when constructed for the loads to be carried will cost almost as much as the concrete and lack concrete's durability. It must be remembered that in addition to the planes themselves landing, and taxiing over the field, heavy trucks will use the runways at times in giving service to the planes.

Where the airport can be located on a body of water of sufficient size, additional provisions should be made for amphibians or seaplanes. Since the planes will land and take off from the water, buildings for their accommodations will be located along the shore and one or more concrete runways will extend from the ramp to a point several feet below the surface of low water.

The present features to be considered in the layout of the modern airport are listed in the table shown on this page. This table conforms in most respects to the preliminary requirements of the United States Department of Commerce. The table should be carefully studied in planning the airport. Service, convenience, accessibility, and appearance must be provided today for the many municipal airports that soon must serve not less than 500 planes a day.

Water Flow Formulas

The following paragraphs from the June New Reclamation Era give the formulas used by the engineers of the U. S. Bureau of Reclamation for estimating the flow of water in pipe lines of various materials:

Let Q=discharge in cubic feet per second.

D=diameter of pipe in feet.

d=diameter of pipe in inches.

H=friction slope in feet per 1,000 ft.

Wood Stave Pipe

$$Q=1.21\ D^{2.65}\ H^{0.555}$$

This is Scobey's formula modified by a safety factor of 5 per cent, as recommended on page 66, Bulletin 376, United States Department of Agriculture.

Cast Iron Pipe

$$Q=1.31\ D^{2.7}\ H^{0.555}$$

This is the formula given in Bulletin 376 referred to above. The Bureau of Reclamation has had very little occasion to calculate the flow of water in cast-iron pipe.

Precast Concrete Pipe

For pipe 12 in. to 21 in. in diameter:

$$Q=0.00179d^{2.625}\ H^{0.5}$$

For pipe larger than 21-in. diameter:

$$Q=0.00192d^{2.625}\ H^{0.5}$$

These are Scobey's formulae modified by a factor of safety of 5 per cent as suggested on page 54 of Bulletin No. 852 of the United States Department of Agriculture, the values of Scobey's coefficient C_s used being 0.345 for 12-in. to 21-in. diameter pipe and 0.370 for pipe larger than 21-in. diameter. Owing to the inability of working inside of the smaller group of pipe the finished joints between pipe units are rougher than for the larger group.

Monolithic Concrete Pipe

For monolithic concrete pipe cast in place, the Chezy formula is used, with Kutter's n=0.014.

Riveted Steel Pipe

The bureau now has no single formula for universal use in calculating the flow of water in riveted steel pipe. For the smaller sizes of pipe, where plate thicknesses and rivet heads are not large, the Hazen-Williams formula is used. This formula is $V=Cr^{0.63}\ S^{0.54}\ 0.001^{-0.04}$. The value of C is usually taken as 100, r is the hydraulic radius and S is the slope. For the larger sizes of pipe the Chezy formula is used. The value of Kutter's n used varies from 0.014 for the smoothest condition of inside surface up as judgment dictates.

Drain Tile

For drain tile, the practice has been to use the Chezy formula with Kutter's n=0.015.

Experiences of York Water Co. in Reforestation of Water Sheds

Abstract of Paper Presented at 48th Convention Am. W. W. Assn.

By EDGAR P. KABLE
General Manager, York Water Co., York, Penn.

THE water works authorities, being so busy protecting their supplies, rarely consider that by reforesting their sheds they increase the timber reserves and are creating an asset which is becoming more valuable every year. The "harvest is on" almost from the start if properly planted. If evergreens are used and planted close some can be removed within a few years and readily sold as Christmas trees, leaving the remainder to mature. With the exception of a few varieties, after once a tract is completely planted it will perpetually regenerate or maintain itself by the falling of the seeds to the ground beneath and the sprouting of the same. This natural regeneration can be assisted by the sowing of additional seed at the thinner stands.

Selection of Species for Planting.—The species of tree to be selected for planting on a water shed depends on the locality, soil, elevation and effect of the leaves or other flowers which fall from the trees.

Some of the deciduous trees deposit leaves which within a short time mould in process of decay and impart an objectionable odor, color and taste to the water which is eliminated with difficulty in the process of filtration. These leaves are also objectionable if they find their way onto the screens of an intake channel of a pumping station and obstruct the flow of the water.

This has been overcome in certain localities by planting evergreen trees along the waters' edge and planting the deciduous trees at some distance from the water. In this way the evergreen trees act as a barrier or trap and hold the leaves, whereas the needles of the evergreens usually imbed themselves on the surface of the ground and rarely reach the water.

The evergreen tree where practicable to plant, appears to have some advantage over the deciduous tree for water shed protection in that the needles deposited beneath the tree create a soil condition which permits the precipitation to more readily penetrate the top surface of the soil, whereas the litter formed on the ground by the deciduous tree becomes wet and slimy with the initial rainfall and the remainder of the rain has a greater tendency to flow over the surface to lower points.

When a tract selected for reforesting is found to contain scrub trees of a different species from that intended to be planted, it becomes necessary to cut down these scrub trees and cut their sprouts annually for the first three or four years as this growth shades out the new trees. This is particularly true of cases where hardwoods are replaced with conifers.

The Size of Trees for Planting.—A very important matter to be considered in the outset of a reforesting project is the selection of the size of tree. A seedling tree is one that has grown in the nursery or set in a bed for two or three years from seed during which time it has not been transplanted. Transplants vary depending upon the kind and duration of the transplanting period. The expression 1-2 transplant means that when the seedling was 1 year old, it was transplanted and then remained in the nursery for two years more giving it a total age of 3 years. The expression 1-2-1 transplants means that when the seedling was one year old it was transplanted and after two years it was transplanted again and then remained in the nursery for another year, giving it a total age of four years. The expression 2-2 transplant means that the seedling was transplanted at the age of 2 years, and then remained in the nursery for two years more, when it had a total age of 4 years. The expression 1-2-2 transplant means that the seedling was transplanted at the age of 1 year and after two years was transplanted, also again after two years was transplanted giving it a total age of 5 years.

Too Small Trees Undesirable.—The experience which I have had with planting has shown that too small a tree is equally as undesirable as too large a tree for successful reforesting. The loss the first year in using seedlings has been as much as 30 per cent. It is true that this 30 per cent can be replaced the second year yet, as a rule the labor of planting is the expensive part of reforesting. If a large tree, say a five year transplant, is used the trunk is rather rigid and when the wind sways the tree it creates an opening in the ground down to the roots and permits the air to enter. A three year transplant seems to be the desirable tree to plant. The trunk is flexible enough to permit the wind to sway it back and forth without creating the objectionable air pocket. The system of roots in this sized tree are numerous and compact. In the plantings at York, Penn., when over 100,000 trees were planted in a single season the loss in the first year was as low as 2 per cent.

When the trees are received from the nursery, great care should be taken in unpacking to see that they are not exposed to the air as the roots dry readily and the tree dies. Immediately after unpacking, the roots of the trees should be immersed in a compound of earth and water about the constituency of cream and then should be heeled in while in bunches in a furrow so that the roots and trunks are completely covered, letting only the top remain exposed. They can remain in these trenches while the planting is progressing. The time to plant will depend entirely upon the location but should be done as early in the growing season as practicable. Spring seems to offer some advantages over fall planting.

Small nurseries located on a desirable lot adjoining a water shed are not only desirable but profitable. Seeds or seedlings can be planted in rows and with very little care will produce plants suitable for forestry planting within three or four years at a nominal cost with the added advantage that the plants are available for planting early in the season within the area to be reforested. This avoids the necessity of extensive packing and often long and expensive hauls with the accompanying losses in transit.

Fire Prevention Measures.—The greatest enemy of the forest is fire. Fire originates in most cases from the carelessness of man and every precaution should be taken to protect the trees from this hazard. Fire lanes through the tracts should be provided where there is a sizable planting. These lanes should lead from the main highways and should be of sufficient width so that when the trees mature they will permit men on horseback to pass back and forth through the tract. It is impracticable to make the lanes wide enough to prevent the leaping of the flames across them. The number will depend on the species of tree planted and size and topography of the tract. These lanes should be kept mowed close to the ground and free from dry grass or other inflammable material. An

equipment consisting of fire rakes, axes, approved chemicals or other extinguishers should be kept at convenient stations on the tract. If the forest is of sufficient size and so located that all trees cannot be observed from a common point, an observer's tower should be provided and observations made continuously if the tract is used by the general public so that the first curl of smoke can be detected and an alarm given immediately. Usually this matter is ably handled through the various State Bureaus and every owner of a forest should be in close touch at all times and confer with the active heads of these bureaus. The spring and fall seasons during which most of the fires occur, the greatest precautions should be taken and during these times it is important that extra patrol be carried on.

Another hazard is disease, but fortunately in this agency, the most fatal disease attacks only one species,—as for example the chestnut blight attacks only the chestnut tree and the white pine blister rust the white pine tree. By planting several varieties on the same tract the likelihood of total failure through disease is practically eliminated.

Through the prompt action of the Federal authorities and those of several of the states the blister rust appears to be under control at least for the present.

The white pine weevil also attacks the leader of the white pine trees and stunts its growth but does not as a rule prove fatal to the tree.

The writer has had experience with apparent success with the planting of red pine, white pine, European larch, silver fir, douglas fir, hemlock and Norway spruce.

Plantings of York Water Co.—The impounding basin tract of The York Water Co. located along the Susquehanna Trail four miles south of the city of York, Penn., and 45 miles north of Baltimore, Md., contains about 700,000 evergreen trees of the above mentioned varieties in a very flourishing condition. The land is rolling, being typical of Pennsylvania, and formerly constituted farm land in a high state of cultivation. This is the tract which the eminent authority, Dr. C. A. Schenck of Darmstadt, Germany, formerly director of the Biltmore Forest School, declared to be the best example of evergreen reforesting in the world. The first plantings were under the personal direction of Professor J. W. Toomey, Dean of Yale Forest School. Dr. Joseph S. Illick, State Forester of the Commonwealth of Pennsylvania and his staff and Major Robert Y. Stuart, now United States Forester rendered valuable assistance. This tract is visited frequently by foresters of the various states and others interested in forestry and the management of The York Water Co., York, Penn. will be pleased to have you all visit the tract at your convenience.

Summarizing the subject we find trees where there is water and water where there are trees and no trees where there is no water and no water where there are no trees. Water is what we want and by nature the trees follow and we believe we can hurry along more water by planting more trees, so let us help the coming generations by planting the forests and let them stand as our heritage to future generations and an abundance of aqua pura will follow.

It may not be amiss to quote Humboldt's saying: "How foolish is man in destroying the mountain forests, as thereby he deprives himself of wood and water at the same time."

City Transportation Bureau Centralizes Control of All Municipal Cars

The city of Baltimore, Md., has a bureau of transportation which controls the operation and maintenance of approximately 350 motor vehicles of the city government. These include the equipment of all departments except the police and fire departments, public parks and city hospital. An interesting account of how the bureau functions was given by Charles W. Pohlman, Superintendent, in a recent issue of the Municipal Journal, the official publication of the city.

On Sept. 1, 1925, the day on which the bureau started active functioning, a dispatch system was inaugurated, working much on the same basis as taxicab service and assuring all department heads and their assistants of quick transportation, cars being furnished with or without chaffeur. The system has since proved of great service to those officials who, having no cars assigned to their departments, were forced of necessity to use taxicab or hired cars. There are 20 cars used for dispatching while all other cars are on permanent assignment to inspectors, foremen, etc., of various departments.

Prior to the passage of the Ordinance organizing the bureau, there were 22 departments which purchased, operated and maintained their own equipment, while other departments either had no means of motor transportation or used taxicab or hired cars. The bureau is now serving 35 departments with transportation and the occasion for hired cars is rare.

There being no appropriation allotted by the board of estimates for operating expenses, all operating funds other than office salaries are obtained from the revenue collected from the various other departments through vouchers rendered monthly. Charges are made through rates set up annually, estimated so that the total revenue for the year will not exceed the amount necessary for the operation and maintenance of the old vehicles and the purchase of new equipment. The rates so applied, vary in accordance with the different classes and types of cars and trucks.

In its efforts to centralize the storage of city cars, the bureau has gradually brought about the elimination of storage in private garages, for which rental was paid, and thus effected quite a savings for the city. There are still a few cars stored out, this being necessary because they are assigned to health department doctors and special investigators who are liable to summons at any time of the night.

Up to the time the new municipal garage in the basement of the municipal office building, was put into use, the cars under the jurisdiction of the bureau were stored at five different city yards. Most of these cars have already been transferred to the new garage. There is space available for from 150 to 175 cars. As the trucks are no longer under the jurisdiction of the bureau, they were transferred back to their respective bureaus on Oct. 15, 1927, only cars will be kept in the municipal garage.

Water Accounts at Columbus, O.—According to the recently issued report of the Division of Water of Columbus, O., C. B. Hoover, Superintendent, at the close of the year 1927, the total numbered services was 58,206, this being composed of 55,088 active services and 3,118 inactive, or services in no way used during the year for delivery of water. Excepting 458 services, all active services are metered; and included in the 458 unmetered services, are 169 taps for flushing sewers and 178 private fire protection services, representing the automatic service mainly. The average net amount received, per service, for semi-annual metered water was $10.48; the monthly services average $235.38. Per service, it cost $2.38 to pump the water; purifying, $3.78; and total cost of operation, plus interest on bonds and sinking fund charges, was $22.04. From commercial consumers, numbering 2,659, 53.9 per cent of the revenue received for metered water supplied, was received; and from 51,032 semi-annual consumers, 46.1 per cent was obtained.

Use of Oil Burners Reduces Ash Collection.—A significant item appears in the report of the operations of the Engineer Department of the District of Columbia for the fiscal year ended June 30, 1927. In the report of the city refuse department Mr. Morris Hacker, Supervisor City Refuse states:

"The quantity of ashes collected was within 1 per cent of that collected in the previous year, indicating a mild winter, and also the growing use of oil burners, which seems to balance the increased number of residences."

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The Immigration of Research Technicians

"After eight years as engineer and head of the research bureau of the Royal Board of Water Falls in Stockholm, Sweden, Dr. Harold Nordiner is now a consulting engineer for the Westinghouse Electric and Manufacturing Co." He has invented an oscillograph for automatically recording voltage surges on power lines, due to lightning or analogous causes.

Dr. Nordiner's immigration to America is typical of that of hundreds of European scientists and engineers since the end of the world war. Many of our large manufacturing companies have developed great research departments that are constantly growing, and with their growth comes an increased demand for experienced research engineers. It takes no marked prophetic instinct to forecast a steadily increasing flow of research technicians into this country from all the countries of the world, for here is the greatest chance for fortune and for fame.

Since our unexampled prosperity is founded upon the work of our original men, aided by freedom from restrictions to individual enterprise, it follows that the most certain way of accelerating our march toward universal wealth consists not only in training and employing more of our own engineers as research technicians but in attracting to our shores as many of the most brilliant foreign originators as possible.

The other day a celebrated English scientist, speaking about astronomical progress, said that astronomy might almost be called "that American science." Our highly endowed observatories have made so many discoveries in recent years that the astronomers of Europe look enviously upon the instruments that our astronomers possess. Yet, great as our telescopes are, still greater are planned. Miss Proctor, daughter of a celebrated American astronomer, is now engaged in canvassing the country for ten million dollars with which to build a telescope that will make all others seem to it, as Galileo's first little tube with its spectacle lenses seems to the hugest telescope now in use. Who can doubt that with such an instrument there will unfold many a hidden galaxy vastly greater than our own? And with the discovery of countless new star systems there will also come knowledge of their mutual relationship and their common origin.

Most astronomers now believe that the spiral nebulae are "island universes," or galaxies similar to our galaxy that is "bounded" by the milky way. They explain the fact that spiral nebulae decrease in number as the telescope points more nearly toward the milky way, on the hypothesis that star dust in the vicinity of the milky way obscures the vision. But it is not unlikely that the real reason is this: As the axis of Uranus and the axis of the orbits of its moons point toward the sun, so may the axis of our whole galaxy point toward a stupendous star about which our galaxy revolves, and about which other galaxies (the spiral nebulae) also revolve. This hypothesis explains why the number of spiral nebulae increases as the angle from the milky way increases. The building of the Proctor telescope would probably answer this and many other enigmas; and with the answers would come many a piece of knowledge applicable in everyday affairs, leading to greater and greater prosperity. Let it never be forgotten that Newton's theories of the mechanism of star motions under the action of gravitation and centrifugal force stands second to none in the development of man's knowledge of practical mechanics. Remember also that helium gas was discovered in the sun before its existence on earth was suspected, and that helium is now secured as a by-product from gas wells in Texas and is used in place of hydrogen in balloons.

All nature is so intimately interwoven that a discovery in one realm often throws a flood of light upon some obscure fact in a realm so remote that the two seemed forever separated. For example, who would have dreamed that the history of climatic changes could be read in the periodic variation in the thickness of tree rings, and that this variation in turn would give the history of sunspot variation, which in turn would furnish evidence that planets cause sunspots?

The student of the history of science soon becomes familiar with its unfailing economic fruitfulness, but unfortunately this characteristic is not generally appreciated even by educated men. Were it fully appreciated every large manufacturer would have a scientific research laboratory, and small manufacturers would cooperate in financing and operating similar laboratories. There are said to be 1,000 research laboratories now in America, but most of these are doubtless engaged on problems relating solely to the immediate business needs of their supporters. This, of course, is a step in the right direction, but until researchers are also

given free rein to drive the chariots of their imagination wheresoever they will, the greatest fruitfulness of research can not be attained.

Because Europe, particularly in Germany and England, has long been superior to America in the development of pure science it is the part of wisdom not only to read the works of her brilliant discoverers, but to induce many of them to take residence among us.

A Plea for Adequate Rewards for Scientists

The lodestone that attracts the most brains is gold. Sordid as this may appear, history quite clearly indicates its truth.

When gold was most readily secured by conquest, the ranks of the warriors were filled with brilliant men. In fact, most of the ancient thrones were thus founded, along with the houses of the lesser rulers.

When gold was most readily secured by skilled craftsmen, great numbers of bright minds flocked into the profession of art. Grecian art, for example, did not flourish so greatly because art was then adolescent, but because it paid well to be a great artist. And again in the pre-Victorian age when opulence became common, portrait painters flourished as they had never flourished before and have never flourished since. De Guerre's invention knocked the profit out of painting; and profit gone, the great portrait painters disappeared. The camera ended their career.

Much of the genius, as well as much of the folly, of the world has been assembled at Hollywood. There the camera has developed a new art that makes the popularity of all previous arts seem small; and coincidentally is bestowing Aladdin fortunes upon the leading artists and business managers alike.

Ever since the "industrial age" was ushered in eight generations ago by the steam engine, manufacturing has offered great prospects of great profit, and has vastly enriched thousands of men. Consequently many of the ablest men of the world have gone into manufacturing. It is this high order of manufacturing ability that accounts largely for America's phenomenal prosperity. By the side of H. G. Wells' phantasmal puppets that are presumed to typify the successful manufacturer, set real manufacturers like Rockefeller, Carnegie, and Ford, if you wish to see some of the reasons why America is great.

True it is that our greatest manufacturers have always leaned heavily upon the shoulders of inventors and engineers, and they, in turn, upon the shoulders of pure scientists. True, also, that the last named have commonly been so ill rewarded that our whole thesis seems to be belied by that fact. But fame to some men is a reward more prized than wealth. It was fame that drew Newton and Faraday and Einstein into the ranks of the scientists. But for every such genius so drawn, probably a hundred men of equal mental power and assiduity have been drawn into the management of manufacturing enterprises, for to the great majority of men, income still takes precedence over laudation, and a mansion is preferred to a mausoleum.

If so, our plea to such men becomes a plea for better financial rewards to the men of pure and applied science. An enlightened self-interest should teach the wealthy manufacturer that greater income for the original men of science and engineering will result in a more eager thronging of their ranks by the geniuses of the world, and this, in turn, will multiply the profits and the power of the executive geniuses who employ them.

There is evidence that this thought is taking hold of great executives here and there. It is seen first, in the fact that about 1,000 research laboratories are now maintained by American manufacturing companies, and, second, in the fact that here and there an employee in these laboratories emerges with a fistful of gold. Still the path to a general acknowledgment of the wisdom of rich pay for researchers is merely a vague trail through the woods of ignorance, its direction blazed now and again on some tree, but only followed by the keenest eye. No highway yet exists that can be truly called The Highway of Payment in Proportion to Performance.

The True Significance of an America on Wheels

Los Angeles, with a population of one and a quarter million, has more automobiles than the total of four nations having a combined population of two hundred million, namely, Italy, Spain, Russia and Japan. The total motor vehicle registration in Los Angeles is 430,000 in round numbers.

If such statistics lack impressiveness because the comparison is made with countries that are relatively poor, then consider the following totals of registered motor cars:

Germany	422,300
Australia	423,500
Argentina	241,400

The true significance of great motor vehicle registration throughout America lies in the disclosure of the high average incomes of her people. Nearly all our states have at least one motor car per family. Los Angeles county leads all sections, but not by any enormous margin, with one and a third cars per family. In the nations of Europe, few people, other than those classed there as wealthy, own motor cars. Hence, by their standards of wealth, nearly every American is rich. Even by our own standards of a generation ago, most of us are rich.

There is a marked tendency abroad to attribute our prosperity to our natural resources and the world war. The latter aided us not a particle, but really halted our productive increase. The former, namely, our natural resources, is to be found in sufficient abundance in almost every country possessed of large area. Moreover, England has demonstrated that a great manufacturing nation can readily bring to her factories the raw materials of the world as long as her workers remain highly productive. When, through labor union restrictions and socialistic repression of individual enterprise England began to fall behind in per capita productivity, then, and not till then, were loud complaints made as to her paucity of natural resources. Let her once more return to a status of industrial freedom, and it will not be many years before she, too, will be a nation on wheels.

H. P. Gillette

Water and Sewer Developments for the New Town of Westchester, Ill.

Modern Subdividing Methods as Handled Near Chicago

TOWN planning has been evolved from a matter of inadequate first installations and hit or miss additions to the point where everything is amply provided for and built long before the first inhabitants arrive, based on sound engineering principles and experience. Typical examples of this sort of modern planning are to be found in some of the recent subdivisions in the Chicago area, notably in projects where entirely new communities are being built up on land formerly devoted to farming. An interesting example of this kind is found in the future town of Westchester, now being developed near the western edge of Cook County, Illinois, now under development as a new suburban community for Chicago commuters. Not only does the planning involve the town of Westchester, that up to this year was swamps and cornfields, but it involves the village of Broadview, to the east, that already contains a scattered population. A complete modern water works system, a complete storm water sewer system, a complete sanitary sewer system, as well as paving, sidewalks, and street lights, are being installed before homes are built, and rapid transit facilities have been secured for direct express communications with the Loop district of Chicago. Parks and playgrounds, schools, and other facilities have also been provided for in the scheme in order that the town will be developed in a logical manner. All design and construction work have been placed under the charge of a firm of consulting municipal engineers.

This ambitious plan of town development is a good example of modern thought in the matter of subdivisions and town development. Especially interesting are the water works and sewer systems, the data on which, presented in this issue, were secured from the engineers responsible for the work.

Water Supply.—The water is obtained from the city of Chicago, with connection with the 24th Chicago main at Austin Blvd. and Railroad St. The connection is by 12-in. main to a meter vault containing two 8-in. style 3 Trident disk meters. Water is taken to Westchester through a 16-in. main 28,600 ft. long. This main supplies water to the villages of Broadview and Westchester. Storage is provided for by a reinforced concrete underground reservoir of 500,000 gal. capacity and elevated water tank 100,000 gal. capacity, with head of 90 ft. The reservoir and tank are in Broadview. The pumping station at this point has three centrifugal pumps; one 500 gpm. against 160 ft. head; one 1,000 gpm. against 160 ft. head; both driven by 40 hp. electric motors. In addition is one pump rated at 500 gpm. against 160 ft. head, combined gas and electric driven, for standby. The total present capacity

Sewer Excavation at Westchester

of the system with present installation will be 3,000,000 gal. per day, which is estimated to be ample for 20 years with only minor additions, allowing a consumption of 120 gal. per capita per day. In future a booster station can be built in the village of Oak Park which will increase the water supply to 6,000,000 gal. per day. This supply should furnish water to the estimated 50,000 people in Broadview and Westchester in the future at the average daily rate of 120 gal. per capita.

To carry the water to the reservoir, 22,860 ft. of 16-in. pipe was laid between the Austin Blvd. connection and the pump house and reservoir, as well as 5,800 ft. between the pump house and the elevated tank which has a capacity of 100,000 gal. The head is 90 ft. from the main to the bottom of the tank. No arrangement has been made for the treatment of the water.

Distribution.—Distribution in the system is from a 12-in. main along Roosevelt Rd. to Broadway, then south on Broadway to 22nd St., then west on 22nd St. to the western limits of Westchester, or approximately through the center of Westchester. The water rate is to be 6.8 ct. per 1,000 gal. from the Chicago mains, plus 4.5 ct. for maintenance and operation, plus 2.0 ct. for attendance, making the total estimated cost of delivered water 13.3 ct. per 1,000 gal.

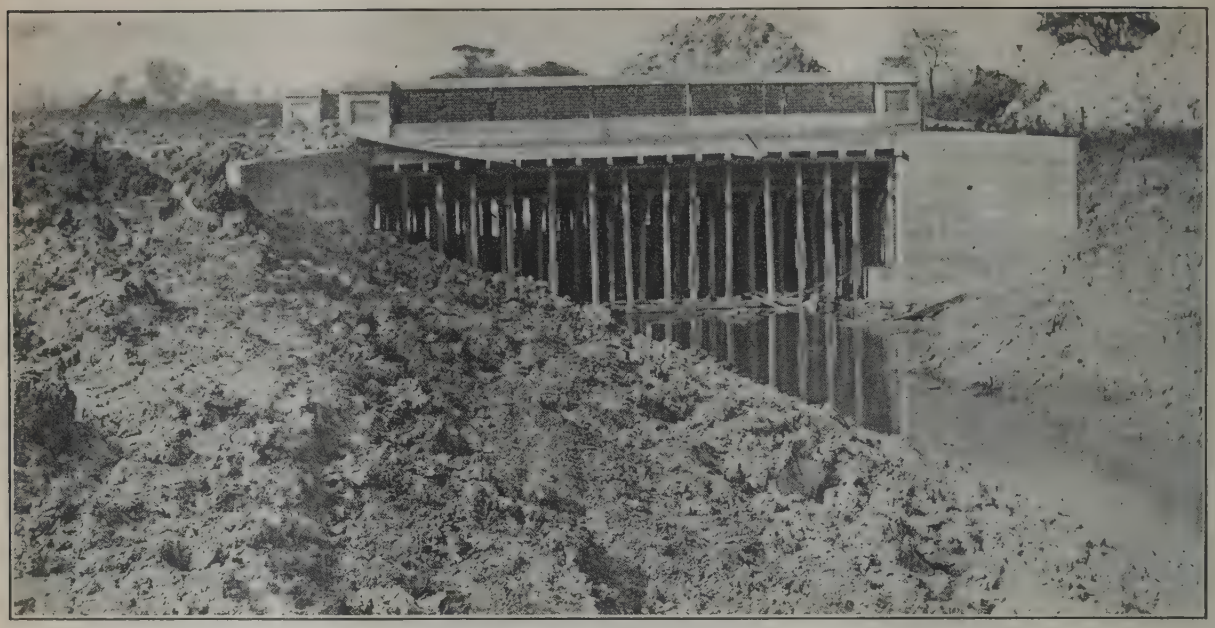
Sanitary Sewers.—The sanitary sewers were designed on a basis of a proportion of runoff using formula $R=CA^{3/4}$. The coefficient in this formula was taken as 0.05 and the coefficient n in Kutter's formula taken as 0.015, as vitrified salt glazed sewer pipe was to be used throughout the systems. An equipment flow was figured for comparison as follows: Figuring 7 lots per acre and 7 people per lot, or roughly, 50 people per acre, the runoff formula shows 450 gal. per 1,000 minutes per person, which is ample to provide for infiltration, house drainage, and a factor of safety to allow for storm water entering the sanitary system. Ample design for infiltration and accidental roof connections has proven to be good practical policy in the Chicago area, due to extreme difficulties encountered in administering separate systems.

The greater portion of Westchester is flat, which necessitated minimum grades and therefore larger sized sewers than would be required in more rolling country. A minimum sewer size of 10 in. was adopted, however, and as may be seen from the distribution table, a larger percentage of the sanitary sewers are of this minimum size.

Due to the flat grades it was found necessary to include a sewage pump pit for the largest system designed to

Table I—Distribution and Fire Systems Laid and Under Contract to Date

	16 in.	12 in.	8 in.	6 in.	4 in. Hydrants	10 in.
Supply line	28,600	.....	.....	.....	.....	.....
Roosevelt Rd. system	.....	10,800	26,700	83,800	 285	.....
Second terminal addition system	.....	.....	4,035	8,455	 29	.....
22nd St. addition system	.....	1,340	3,777	7,846	 36	.....
Woodlands and Highlands system	.....	5,330	10,075	22,900	940 97	1,275
Totals	28,600	17,470	44,587	123,001	940 447	1,275



New Bridge Over Waterway in Park

date in order to discharge the sewage at times of high water in the interceptor. The outlet for this system is at the east limits of Westchester on Roosevelt Rd., at which point the sewage is discharged into a 60-in. sewer operated by the Sanitary District of Chicago. The sewage pump pit was built at this corner and serves to lift the sewage into this 60-in. sewer whenever it begins to back up into the Westchester sewage system. The pumps in the pit are automatically operated by a float which also operates sluice gates to prevent the flow from reversing. The distribution of sewer sizes on projects now under contract is shown in Table II.

Sewage Pumps.—Two Yeomans vertical dry pit non-clogging centrifugal sewage pumps each having capacity of 1,000 gpm. at a total head of 25 ft. were installed in the pit. The use of Presstite joints reduced infiltration to the allowable limit of 5,000 gal. per 24 hours per mile of sewer on work built to date.

Soil conditions for the most part were favorable, with stiff clay in the soil in most places. In a few of the deeper lines quicksand was encountered but very little difficulty was experienced on account of this. The average cut for sanitary sewers was about 9½ to 10 ft.

Storm Sewers.—The design of the

View Taken at Northeast Corner of Mannheim Rd. and Roosevelt Rd.

Constructing Sewer in Gladstone Ave.

storm sewers was based on the formula $R=CA^{3/4}$, using $C=70$ and $n=.015$.

In the case of the storm sewer design as with the sanitary sewers the flat nature of Westchester necessitated very flat grades and consequently larger sizes than would be the case were the country more rolling. Storm water, which includes water drained from roofs, and street drainage, is discharged into Addison Creek, which was straightened and deepened as part of the storm sewer project, and Salt Creek, which runs through the southerly part of Westchester. Particular care had to be taken in establishing the grades of the storm sewers to prevent interference of the house connections from the sanitary sewers, with

Table II—Sizes of Sewers

Size	27 in.	24 in.	21 in.	18 in.	15 in.	12 in.	10 in.	30 in.
Roosevelt Rd. system	1,210	2,730	1,300	380	2,530	7,900	47,810	.....
22nd St. system	.....	2,010	4,830	2,500	4,950	4,120	38,860	.....
Woodlands and Highlands system	190	640	.....	1,880	.....	420	20,410	3,200
Second terminal addition system	820	3,280	.....	640	.....	.....	8,310	.....
Totals	2,220	8,660	6,130	5,400	8,480	12,440	115,390	3,200

Excavating for New Waterway in Park

the storm sewers. Several plans were developed and the most economical design as determined from average contract prices in the Chicago area was adopted. Some difficult and expensive features of the largest storm sewer project made the construction interesting. It was found to be necessary to construct an inverted syphon in the 84 in. outlet line on Roosevelt Road in order to leave clearance for a future track extension of the C. W. & W. R. R. The sewer at this point was depressed 11 ft. for a distance of 116 ft. the total length of inverted syphon being 196 ft. This structure was built of monolithic concrete and consists of two conduits.

Another portion of the sewer was laid through a deep peat bog and it was found necessary to support this line on a trestle structure which rests on piles.

Approximately 1,000 ft. of 72 in. storm sewer and the same length of 21 in. and 15 in. sanitary sewer were built in this manner.

Construction Notes.—At the point where the water main leading to the project crossed the DesPlaines River, a small stream normally about 50 ft. wide and 2 or 3 ft. deep with a very sluggish flow, a cofferdam of double rows of sheet piling was first constructed, and excavation by hand then produced a trench in which the pipe could be laid. Work was done in winter in order that the men could work from the ice. The main was laid 3 ft. below solid bottom at this point. Street crossings in Oak Park were negotiated by tunneling and then filling the tunnels with concrete by hand methods. This rather expensive method of putting the main under streets avoided interruption to traffic. On trenching for the main, the usual cut was about 7 ft., except at railroad crossings where the cut was about 12 ft. in order to provide greater cover. An Austin trencher, a Parsons backfiller, and a crew of about 8 men resulted in an average output of from 600 to 700 lin. ft. per 8-hour day. Pipe was handled with a chain block on a tripod. Pipe was distributed along the trench in the course of delivery and no rehandling was involved except for laying it in the trench. It is interesting to note that fire hydrants were placed at intervals of 330 ft. throughout the distribution system. The average depth of cover in the distribution system was 5½ ft. The trenching and pipe laying methods were the same.

Construction View of Storm Sewer Operations at Westchester

Storm Sewers.—The dredging of the main channel of Addison Creek was done with draglines and power shovels, the latter loading into dump wagons drawn by tractors. The channel of the stream was corrected, to provide better runoff, and the old channel was filled with material excavated from the new channel. The total excavation was approximately 60,000 cu. yd., mostly clay. A concrete revetment wall was laid on one curve, involving 210 cu. yd. of reinforced 1:2:3½ concrete.

The work was designed and was constructed under the supervision of Consoer, Older, and Quinlan, Consulting Engineers, Chicago, with Geo. O. Consoer and H. Kent, Jr., in charge of design, and Arthur W. Consoer, Wm. G. Mawhinney, Horace H. Smith, J. A. McFadden, and C. A. Case in charge of construction. Concrete pipe was furnished by the Independent Concrete Pipe Co., most of the Westchester pipe work was done by the L. E. Myers Co., Chicago, contractors, and other contractors were responsible for various supplementary contracts. The elevated tank was constructed by the Chicago Bridge & Iron Works. The main from the Chicago stub to the distribution system was laid under sub contract by Mills & Son, Contractors.

Table III—Storm Sewer Distribution System

	84 in.	72 in.	42 in.	36 in.	33 in.	30 in.	27 in.	24 in.
Roosevelt Rd. system	1,470	1,430	.....	.....	310	1,850	1,990	3,150
Second terminal addition system	.....	.....	.....	.....	.....	.....	.....	.....
22nd St. system	.....	.....	1,260	1,170	2,130	3,310	5,130	1,640
Woodlands and Highlands system	.....	.....	340	.....	.....	.....	.....	.....
Totals	1,470	1,430	1,600	1,170	2,440	5,160	7,120	4,790
	21 in.		18 in.		15 in.	12 in.	48 in.	54 in.
Roosevelt Rd. system	6,000		8,700		14,100	27,400	.....	.....
Second terminal addition system	.....		5,310		2,700	2,650	.....	.....
22nd St. system	2,140		8,050		16,620	20,940	1,550	.....
Woodlands and Highlands system	.....		1,820		6,660	16,560	660	920
Totals	8,140		23,880		40,080	67,550	2,210	920

Removing Sediment with Dynamite

The accumulation of mud and other sediment, which largely decreases the usefulness of waterways and of ponds used for water supply, has always presented a problem and involved considerable expense in restoring capacity.

However, an easy and comparatively inexpensive method was resorted to by the North American Cement Corporation at its Howe Cave, N. Y., plant. Dynamite was used to remove mud which had accumulated at the intake and over a distance of about 300 ft. toward the center of the pond. The filling in had changed the course of the intake channel and greatly reduced its capacity. Therefore blasting was done to straighten out the intake channel and to increase its depth toward the deeper part of the pond.

About 150 to 175 ft. of the line of the new channel was loaded by hand in about 2 ft. of water, the blaster working from a flat bottom boat. On account of the nearness of the plant buildings and the possibility of the water transmitting the shock of explosion to the plant, extra heavy loadings were avoided, and four separate shots were used in excavating the first 300 ft. But the load was gradually increased as the distance from the intake was increased and the work was carried toward the deeper water.

A spacing of 18 in. in a single line of holes was used for the entire length of the channel. Near the intake two cartridges were loaded per hole, while the loading was increased to four cartridges in the deep water.

The bottom of the pond was deep, soft mud except for about 50 ft., near the intake, which was clay.

Scarcely any vibration from the blasts was felt at the plant and the power house.

Recent Developments in Application of Chlorine in Water Purification

An Outline of the Progress in 1927-28

By L. H. ENSLOW

Research Engineer, The Chlorine Institute, Inc., 30 East 42nd St., New York City

THE practice of applying chlorine to the raw water or the coagulated water at some point ahead of the filters has received marked impetus during the past twelve months.

It is increasingly evident that in many instances the sources of supply of raw water are becoming so polluted with sewage as to make it impossible to depend entirely on coagulation and mechanical filtration. Pre-chlorination has in several instances been effectively applied to relieve the strain on the filtration process by reduction of the bacterial load on the filters. Final or post-chlorination has been reduced and in conjunction with pre-chlorination can be considered primarily as a factor of safety. Pre-chlorination is receiving increasing attention also because effective purification may be had without the necessity of maintaining residual chlorine in the filtered water to the extent otherwise considered advisable for a high degree of safety. Algae growths, so frequently a disadvantage in coagulation or settling basins, seem to have been effectively reduced or controlled by chlorination of the raw water. Filter runs have been materially increased, wash water consumption reduced, and the general condition of the filter beds has been improved. In at least one instance the filters have produced a sparkling effluent which prior to pre-chlorination could not be procured. It appears that chlorination ahead of the filters is effective in reducing the "slime" on the sand grains and thus the filters are more effectively washed. The occurrence of mud spots, mud balls, and breaks or cracks in the sand bed has been minimized.

With some grossly polluted waters, putrefaction and liquefaction of the deposited sludge in the coagulation basins sometimes results in fouling of the incoming fresh water and eructations of sludge from the bottom of the basins. It seems that pre-chlorination is effective in retarding this putrefactive action; basin washing is cut down and the taste of the water improved.

Several instances have been reported in which reduction of coagulant has resulted from pre-chlorination. This advantage, however, can not be predicted unless the water is known to contain iron, and an actual trial is necessary to determine in each case what value pre-chlorination as a coagulant saving process may possess.

Recent Results from Pre-Chlorination at Various Places.—It should be pointed out in the beginning that the pre-chlorination data very difinitely support the conclusions of H. W. Streeter[1] and associates that filters will not produce an effluent meeting the Treasury Department Standard when the raw water contains many more than 60 B. Coli per c. c.

Sandusky, Ohio: (Lake Erie Water).[a] —O. F. Schoepfle, Chemist in Charge at the Sandusky plant began pre-chlorination of raw water in May, 1926, with the sanction of the Ohio State Department of Health. Progress reports are included in the 1926 and 1927 Proceedings of the Ohio Water Purification Conferences. The outstanding results have included longer filter runs, algae reduction, improved coagulation, reduction of chemical costs and improved filter effluents. Fig. 1 graphically presents the bacterial efficiencies secured and Fig. 3 indicates the maximum B. Coli content of the filter effluents with and without pre-chlorination. The reduction in monthly averages for B.

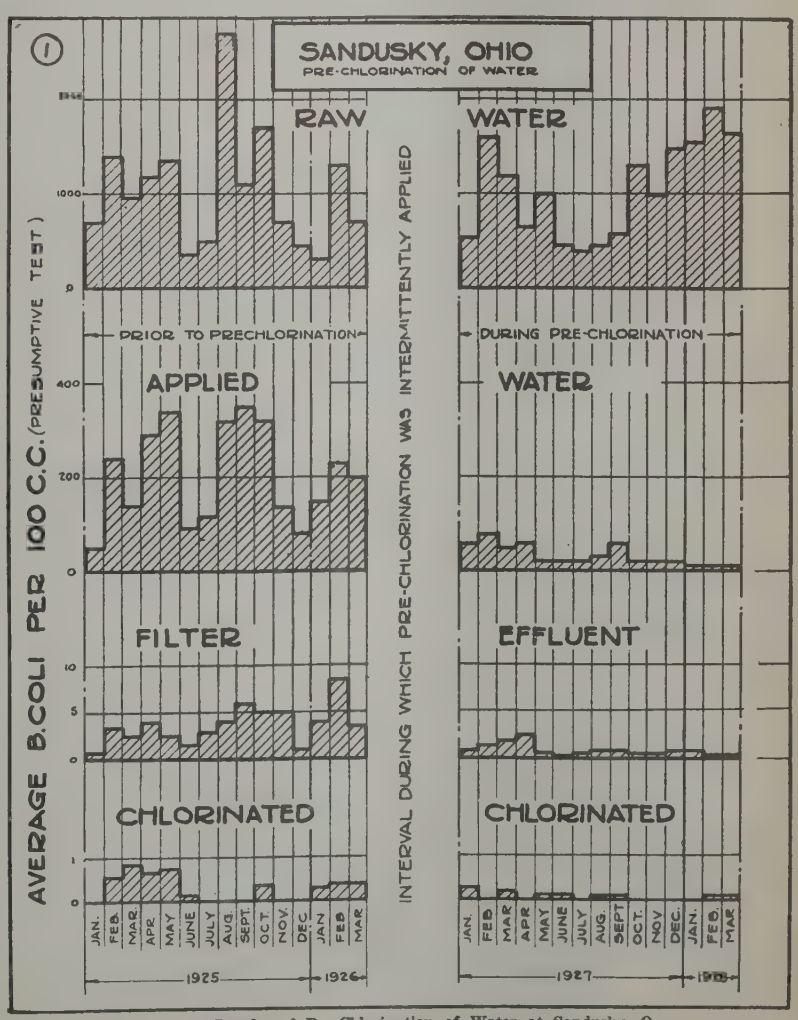


Fig. 1.—Results of Pre-Chlorination of Water at Sandusky, O.

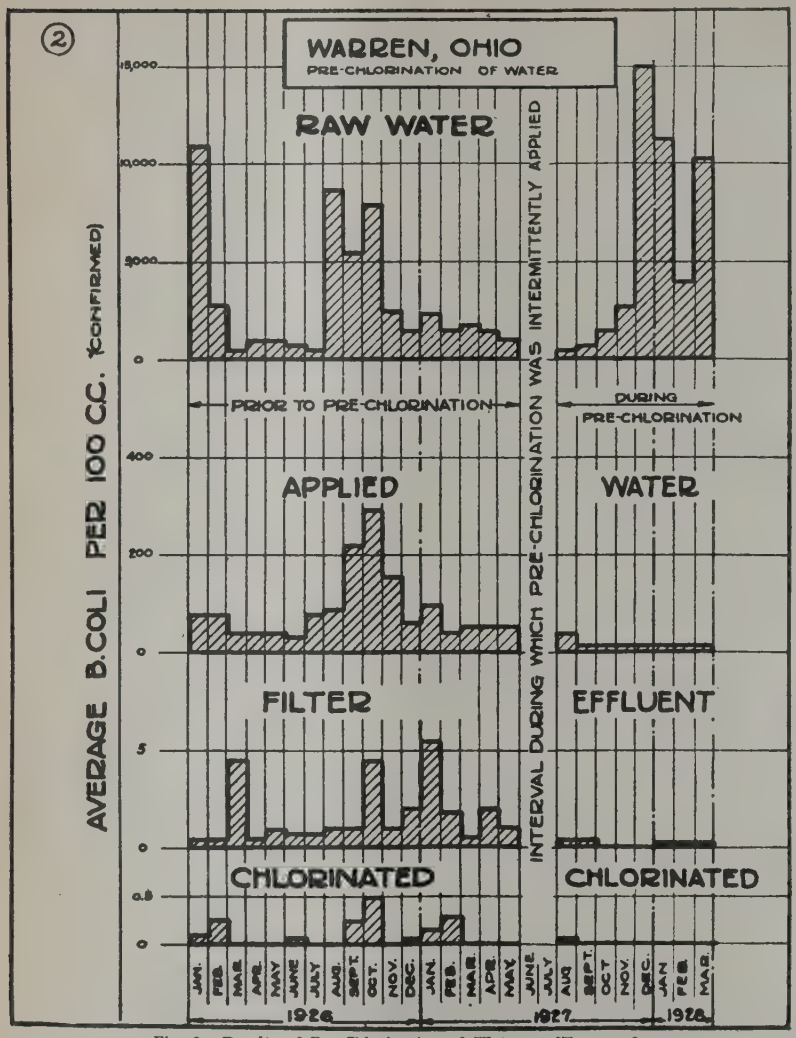


Fig. 2.—Results of Pre-Chlorination of Water at Warren, O.

Coli is of interest, but of greatest interest is the elimination of the spasmodic presence of high coli content in the effluent occurring prior to pre-chlorination as shown in Fig. 3. This effect is of far greater importance than a reduction of the average figures. The average pre-chlorination dosage at Sandusky during 1927 was only 0.37 parts per million and no attempt was made to carry residual chlorine through to the filters. Post-chlorination dosage was 0.32 parts per million, a total of 0.69 parts. For short periods residual chlorine was carried through to the filters without harmful effect and the work is being continued to determine the advisability of maintaining residual chlorine on the filters. During pre-chlorination the filter effluent passed the Treasury Department Standards and post-chlorination merely increased the factor of safety.

Warren, Ohio: (Mahoning River Water).[a]—P. J. O'Connor, Superintendent of Filtration, began pre-chlorination of raw water at Warren, O., filter plant in July, 1927. Detailed results will appear in the 1927 Proceedings of the Ohio Water Purification Conference. The results indicate the great value of pre-chlorination in plants which must handle a water subject to rapid and wide fluctuations in basterial content. The benefits derived include a 33 per cent reduction of coagulant otherwise required to relieve the filters of the high bacterial load, algae reduction, and increase of approximately 20 per cent in length of filter runs. It has been possible to secure a filter effluent which meets the Treasury Department Standard continuously during pre-chlorination. The pre-chlorination dosage was on the average 0.75 parts per million which produced an applied water on the filters containing from a trace to 0.1 p.p.m. residual chlorine. The post chlorination dosage has been reduced from the former figure of 0.35 p.p.m. to 0.23 p.p.m. making a total chlorine consumption of approximately 1.0 p.p.m.

Such a reduction in the final chlorine application is of importance at Warren where the water is pumped directly into the distribution system. There is now a greater factor of safety and less chance of chlorine tastes appearing in the system.

The bacterial results secured during periods prior to and during pre-chlorination are shown in Figs. 2 and 3. Fig. 3 is of particular interest in that it indicates the maximum B. coli content of the filtered water during each month and presents a fair picture of the considerable added safety secured through pre-chlorination which the average B. coli content per month fails to disclose.

Kansas City, Kansas: (Missouri River Water).—L. B. Mangun, Chemist in Charge at the Kansas City, Kansas filtration plant began pre-chlorination of raw water in July, 1927. A detailed paper covering the results was read at the 1928 Kansas Water Operators School at Lawrence, Kan.

Mr. Mangun has not found that pre-chlorination has enabled him to reduce the coagulant dosage and the data so far available indicate no appreciable reduction in wash water. The chief ends sought and accomplished were reduction of bacterial load on the filters, algae reduction, and improved quality of effluent. Figs. 4 and 5 show graphically the effectiveness of pre-chlorination with respect to the average and maximum coli content of the filtered water for each month prior to and during pre-chlorination.

The chlorine dosages applied to the filter effluent and the raw water are shown prior to and during pre-chlorination in Fig. 5. One point worthy of note is the change in total chlorine required with summer and winter conditions. During the cooler months the average total chlorine requirement of 0.68 p.p.m. has been but slightly more than the average of 0.60 p.p.m. formerly required for post-chlorination alone. Mr. Mangun believes from the data already available that the double chlorination practice will increase the total chlorine consumption on an average for the year of approximately 50 per cent or less.

During the summer months no residual chlorine reached the filters when the pre-chlorination dosage averaged from 1 to 1.33 p.p.m. During the winter with dosages of 0.34 p.p.m. to 0.49 p.p.m. residual chlorine reached the filters and occasionally appeared in the effluent without harmful effect to the filters having been observed

An important feature has been the reduction of the residual chlorine maintained in the final water following post-chlorination with continued satisfactory sterilization insured. Prior to pre-chlorination a residual of 0.2 p.p.m. was maintained whereas during pre-chlorination 0.08 p.p.m. has been satisfac-

[a] Data from plant reports and published papers analyized and assembled by H. S. Hutton, Wallace & Tiernan Co., Pittsburgh, Pa.

tory primarily because less dependence on post-chlorination is necesasry during double chlorination.

As to the expense of pre-chlorination at Kansas City, Kan., with single chlorination the cost has been 43 ct. per million gallons, and with double chlorination 65 ct. per million gallons.

Hopewell, Va.: (James and Appomatox Rivers Water).—Richard Messer, Chief Engineer, Virginia State Department of Health, has analyzed the data and supplied graphs of the results at the Hopewell filtration plant where J. W. Haller, Chemist in Charge of the filtration plant began pre-chlorination of the raw water early in 1924. (See Fig. 6.)

It is noted that the first effect of pre-chlorination was not beneficial to the filter effluent although a marked reduction in B. coli content of the applied water was promptly secured. During the first few months of pre-chlorination the filters seemed to be unloading gas-producing organisms (presumptive B. coli) and the effluent was inferior in this respect to that prior to pre-chlorination. The observations and statements of J. W. Ellms, Filtration Engineer, Cleveland, O., in respect to pre-chlorination exerting a harmful effect on filter efficiency in the early stages is further confirmed by the Hopewell results. Once this unloading had run its course, however, the effluent remained low in gas-forming organisms.

Attention is called to the record of chlorine consumption which averaged 0.71 p.p.m. during the two years preceding pre-chlorination, whereas the four year average during pre-chlorination was 0.94 p.p.m. which covered the pre and post-chlorine consumption, i. e., an increase of 25 per cent in the total chlorine used. It is understood that residual chlorine is maintained at approximately 0.2 p.p.m. in the final effluent which seems from other experiences to be greater than is necessary for a pre-chlorinated effluent. Apparently then the 25 per cent increase is subject to some reduction without jeopardy to the "factor of safety" which post-chlorination rightly assumes when pre-chlorination also is practiced.

Niagara Falls, New York: (Niagara River Water).[b]—Plant No. 1 at Niagara Falls has its intake well out in the river toward the Canadian side and the plant does not suffer the pollution load that exists along the American shore where the intake of Plant No. 2 is located. The latter plant must handle a water highly polluted by Buffalo sewage and the quality is subject to wide variations as a result.

Pre-chlorination of the raw water is practiced under the supervision of B. T. Dignan, Superintendent of Filtration at Plant No. 2, primarily to relieve the filters of the bacterial load and pollution fluctuations and to reduce the dependence on single chlorination of the filtered water.

The pre-chlorination dosage applied during a characteristic month varied between 0.23 and 0.45 parts per million with a general average approximately 0.3 parts. This is insufficient to produce a filter effluent which will meet the Treasury Department Standard and post-chlorination is at all times essential. The final chlorination averages approximately 0.2 p.p.m. which, without pre-chlorination, would necessarily be greater to insure safety when dealing with such heavily polluted raw water.

Poughkeepsie, N. Y. (Hudson River Water).[b] — Pre-chlorination of the highly polluted raw water is practiced under the direction of T. F. Lawlor, Superintendent of Public Works, at Poughkeepsie. The water also receives double filtration. The primary filters are of the rapid and the final filters of the slow sand type. Post-chlorination is applied to the slow sand effluent. At this plant pre-chlorination and the double filtration make the final chlorination purely a safety factor.

The pre-chlorination dosage during 1927 varied between 0.56 and 0.70 p.p.m. and the post-chlorination dosage varied between 0.13 and 0.22 p.p.m. making a total average dosage of approximately 0.8 p.p.m.

The applied water at the primary filters has a median value of 10 B. coli per 100 c. c. and frequently lower. The primary filter effluent will not continuously meet the Treasury Department Standard, but the secondary filter effluent does so.

Rensselaer, N. Y.: (Hudson River Water).[b]—Under supervision of J. M. Caird, Consulting Chemist, Troy, N. Y., pre-chlorination of the raw water at the Rensselaer filter plant has been practiced for some time. At this plant the heavy pollution of the river necessitates heroic measures and a pre-chlorine dosage of between 1.4 and 1.9 p.p.m. has been applied during 1927—

[b] Data from plants reports analyzed and assembled by C. R. Cox[8], Asst. Engr., New York State Department of Health.

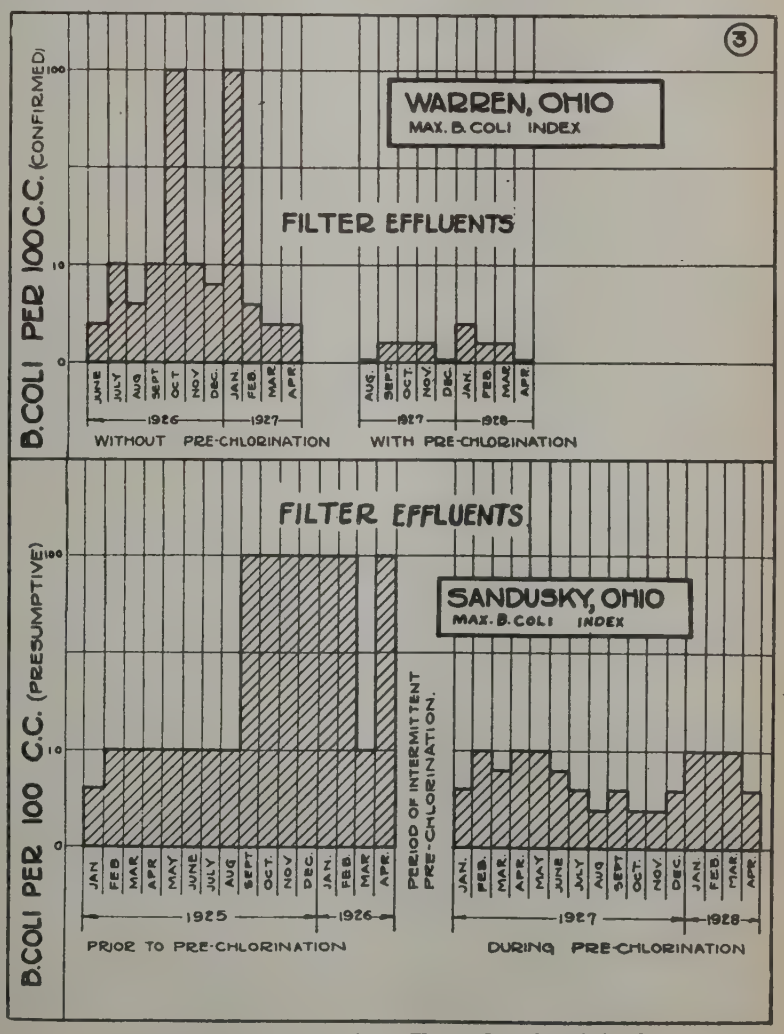


Fig. 3.—Maximum B. Coli Index at Warren, O., and Sandusky, O.

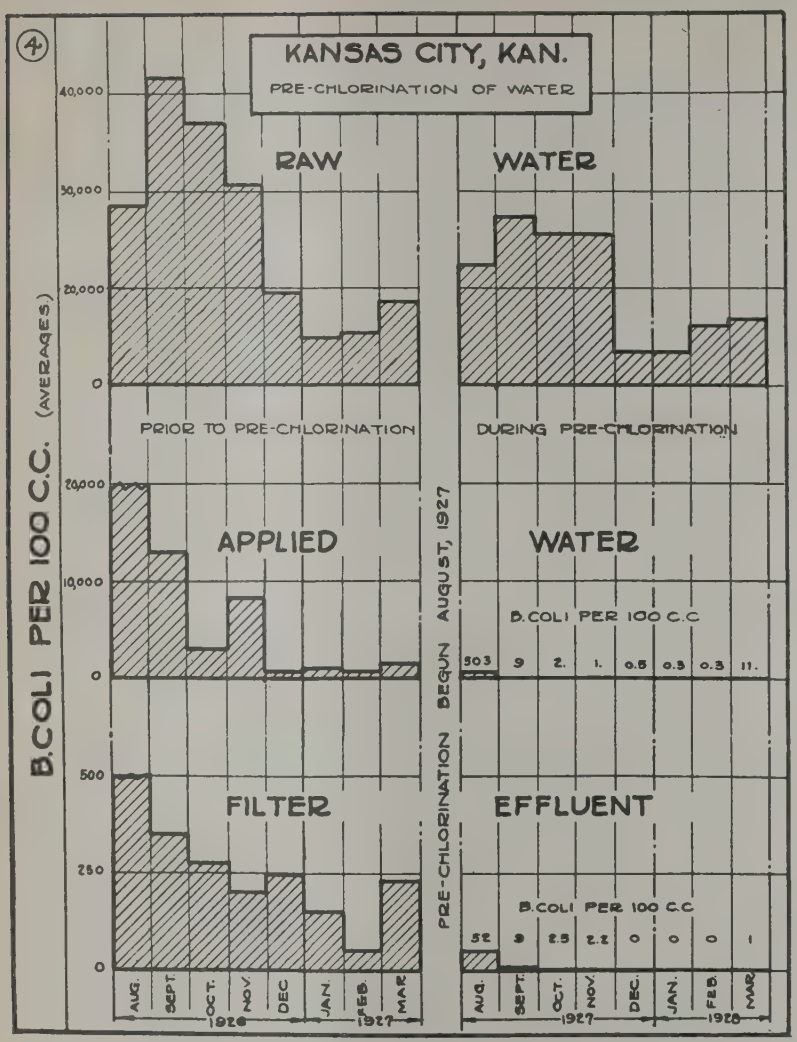


Fig. 4.—Chart Showing Effectiveness of Pre-Chlorination at Kansas City, Kan.

the average being about 1.5 p.p.m. To the effluent is applied between 0.4 and 0.6 p.p.m. to maintain a residual of 0.2 p.p.m. The residual chlorine in the applied water is maintained at approximately 0.5 p.p.m. It is reported that the heavy residual chlorine carried on the filters apparently keeps the beds in an easily washable condition and free of slime and mud accumulations and bed growths. Post-chlorination does not seem to be essential but is continued as a factor of safety because of the considerable dependence on chlorination to produce a safe water at the Rensselaer plant.

Rochester, N. Y.: (Lake Ontario Water).[b]—At the filtration plant of the Rochester and Lake Ontario Water Company, J. F. Amos, Chemist, practices pre-chlorination of the raw water and secondary chlorination of the applied water ahead of pressure filters. The operation is under the supervision of J. M. Caird, Cons. Chemist of Troy.

The raw water is subject to a variable intensity of pollution and organic content which prior to pre-chlorination made it difficult to insure effective sterilization by single chlorine application. At present the major sterilization is secured through pre-chlorination and a minor secondary dosage renders the maintenance of residual chlorine in the final effluent relatively simple. But slight residual is thus required and in connection with the lake water or normally low organic content the low residual chlorine maintained makes the water less liable to chlorinous tastes and odors .

During the period March, 1927-February, 1928, the pre-chlorine dosage varied between 0.20 and 0.67 p.p.m. and the secondary application to the applied water varied between 0.03 and 0.13 p.p.m. The median figure for the total chlorine applied was approximately 0.32 p.p.m.

Raleigh, N. C.:—J. S. Whitener, formerly Superintendent of Filtration at Raleigh, N. C., and now Assistant Engineer of the North Carolina State Department of Health, reports further progress in pre-chlorination at the Raleigh filter plant

Mr. Whitener[2] read a paper at the 1927 meeting of the North Carolina Section of the American Water Works Association which gave an account of the results following chlorine application to the applied water ahead of the filters. An earlier experiment with pre-chlorination of the raw water had not shown any marked improvement in conditions whereas the application to the coagulated and settled water gave a very apparent improvement in the condition of the filter beds and eliminated the "murkiness" previously possessed by the filter effluent. Simultaneously the bacterial quality was improved, and the wash water was reduced. Mr. Whitener now reports further data and continued success. The comparison of the average length of filter runs prior to pre-chlorination (1927) and the same months during pre-chlorination (1928) follows:

Raleigh, N. C.
Average hours filter runs

Month	Prior to Pre-chlorination 1927	During Pre-chlorination 1928	% Increase
January	24	37.5	56.2
February	24	43.6	81.6
March	29	42.5	46.5
April	24	42.4	76.7

The filter beds continue to remain in the improved condition secured following introduction of pre-chlorination. The wash water has been reduced more than 50 per cent. The filter effluent shows no B. coli and the total bacteria average less than 0.5 per c.c. The water in the clear water basin continues to remain clear and sparkling at all times which was not the condition prior to pre-chlorination.

The pre-chlorine dosage over the period January-April, 1928, has averaged 0.32 p.p.m. and post-chlorine dosage 0.16 p.p.m. making the total consumption 0.48 p.p.m. whereas with final chlorination only during the same period in 1927, it averaged 0.36 p.p.m., an increase of but 0.12 p.p.m. Residual chlorine of approximately 0.2 p.p.m. is carried on the filters but this completely disappears during passage through the sand bed and no residual is found in the effluent.

Southern Pines and Fayetteville, N. C.—Mr. Whitener reports that the recent experimental pre-chlorination of the raw organically stained waters at the filtration plants at Southern Pines and Fayetteville indicates that superior coagulation and greater color removal have been secured during pre-chlorination. Simultaneously the filter runs have increased. The State Department of Health has recommended that pre-chlorination be adopted at both plants.

Toronto, Ont. (Lake Ontario Water.)—N. J. Howard, Bacteriologist in Charge, Toronto Filtration Plant, reports that during super-chlorination when pre-chlorination is discontinued

the rapid sand filter effluent becomes slightly turbid and the amorphous matter and bacterial content of the effluent increase preceptibly. In Howard's opinion "pre-chlorination of water, which is non-susceptible to taste production, is at all times beneficial in a physical as well as bacteriological sense."

Chester, Pa. (Delaware River Water.)—Lyle L. Jenne, Chemical Engineer, Chester, Pa., in charge of the Chester filtration plant, reports that pre-chlorination of the raw water was initially practiced to secure elimination of foreign tastes and odors which previously appeared intermittently in the filtered water. The raw water was tested daily to ascertain whether pre-chlorination would improve the taste or odor and the process applied during such periods as the tests indicated it to be of advantage. During the past three years this intermittent practice has been successfully employed. Recently the chlorination capacity has been increased and now continuous pre-chlorination is also employed to reduce the bacterial load on the filters. Publication of data is not warranted because of the limited period during which continuous pre-chlorination has been in use at the Chester plant.

Philadelphia, Pa. (Schuylkill River Water.)—Lyle L. Jenne, Chemical Engr. of the Bureau of Water, Philadelphia, Pa., in charge of the water purification plant, began pre-chlorination of the raw water at the Queens Lane rapid sand filter plant in November, 1927, primarily for the purpose of reducing the bacterial load on the filters. How well this has been accomplished is shown by the following data[c]).

Philadelphia, Pa.
Queen Lane Rapid Sand Filters
(B. coli per 100 c.c. in Applied Water)

	1927 No Pre-chlorination	1928 Pre-chlorination	% Reduction
January	1540	19	98.5
February	1640	410	76.0
March	2250	10	99.5
April	2230	10	99.5
November*	850		
December	16		

*Pre-chlorination begun Nov. 6, 1927.

Baltimore, Md. (Gunpowder River Impounded Water).—James W. Armstrong, Filtration Engineer, Bureau of Water Supply, Baltimore, Md., has forwarded a brief statement concerning pre-chlorination of the raw water at the Montebello Filters during the summer of 1927.

During 1926 the raw water contained biological growths and algae to an extent that caused serious shortening of filter runs and necessitated frequent "jolting" of the filter beds with wash water. Finally it became necessary to wash all of the sand in the filters with Nichols machines.

Beginning May, 1927, pre-chlorination was introduced and Mr. Armstrong has supplied a statement to the effect that "no difficulty with the filters was experienced and the Montebello Filters were able during 1927 to keep up to the increased summer demands without difficulty. The general opinion points to a real advantage from pre-chlorination which will further be substantiated or disproved during continuous pre-chlorination throughout the present (1928) summer." Data from the 1927 operations are therefore withheld.

(c) Courtesy Lyle L. Jenne, Chemical Engineer, Chester, Pa.

Super- and De-Chlorination at Toronto

Norman J. Howard*

Super-chlorination of the City of Toronto water followed by de-chlorination with sulphur dioxide, for taste prevention, was inaugurated in the fall of 1926 and continued for a period of three months. In March, 1927, because of recurrent tastes, instructions were received to resume treatment as soon as possible. In June, 1927, five new machines were added to existing equipment. The available apparatus at this time consisted of eleven Wallace & Tiernan machines of 300 lb. capacity, seven machines being used for chlorination and four for applying sulphur dioxide for de-chlorination. This equipment has since been increased and at the present time consists of fourteen machines, each machine having a 300-lb. capacity per 24 hours. Provision is to be made in the near future for the use of one ton chlorine containers thereby reducing the cost of chlorination to approximately one-half the figures reported herein.

*Bacteriologist in Charge, Toronto Filtration Plants, Center Island, Toronto.

Laboratory experiments previously published[3] showed that taste in Lake Ontario water, caused by the formation of substitution compounds of phenolic and unknown origin occurring in the presence of chlorine, could be prevented by the application of large doses of chlorine. The amount of this reagent was computed at 1.2 parts per million. As the water became colder in the winter months the chlorine had to be increased 2.0 parts. In actual operation covering a continuous period of eleven months from June, 1927, to May, 1928,

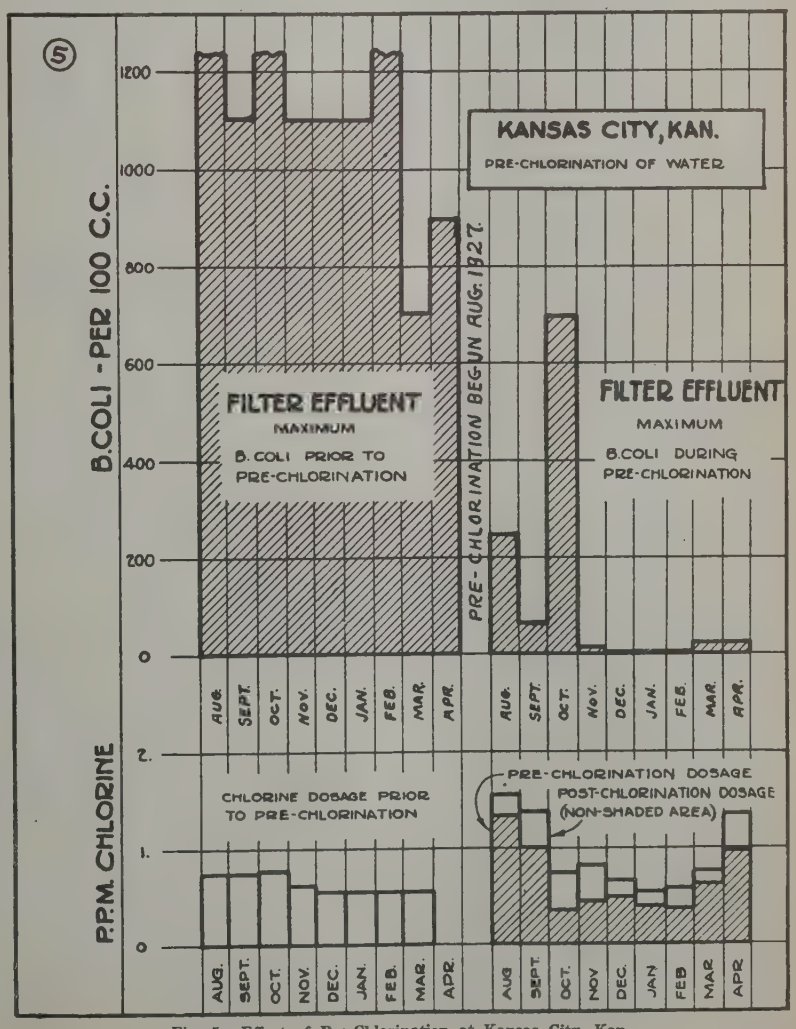


Fig. 5.—Effect of Pre-Chlorination at Kansas City, Kan.

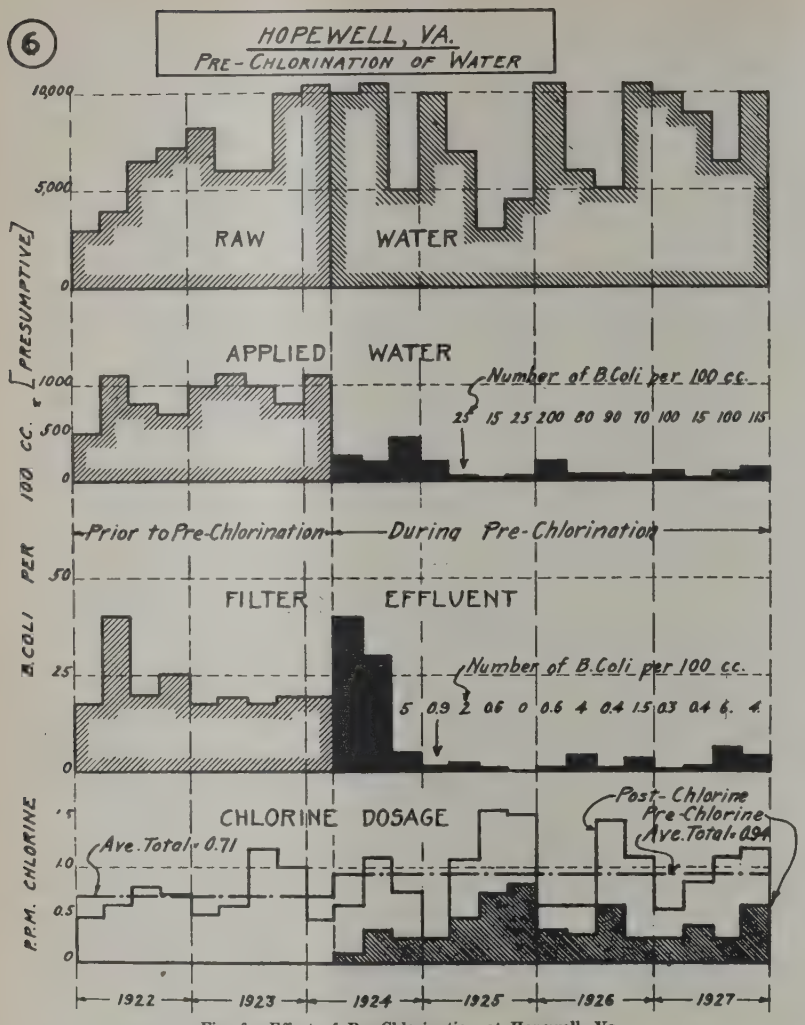


Fig. 6.—Effect of Pre-Chlorination at Hopewell, Va.

the chlorine dosage has occasionally been increased up to 2.5 parts per million.

The treatment of the water for taste prevention is intermittent and is dependent upon the prevailing wind direction. Frequent laboratory tests are made during day and night, the ammoniacal nitrogen test being the index of probable taste production. As the ammonia increases the chlorine dose is raised until the maximum dose is reached. As soon as the laboratory figures show a reduction to normal conditions as judged by chemical tests the chlorine is cut down to the usual dose. The de-chlorinating dose is regulated by ortho-tolidin tests made on the water as it enters the distribution system.

During a 334 day period the treatment was used on whole or in part of 167 days. Not a single taste complaint was filed during the period of super-chlorination. On one occasion, due to faulty operation, the chlorine dose was not increased according to instructions and a distinct taste occurred in the downtown area. Within one hour after increasing the chlorine dosage the water was free from taste.

The importance of complete removal of the residual chlorine, particularly in water susceptible to taste production cannot be overemphasized. Our experience has shown, that taste will only occur in a water which normally would have developed taste following the application of a small dose of chlorine. In other words, non-susceptible water which might be super-chlorinated will not give a post-treatment taste if a slight excess of chlorine is left in the water. From a safety point of view residual chlorine is not needed in water which has been super-chlorinated.

The plans for the new one hundred million gallon mechanical plant for Toronto make full provision for super- and de-chlorination treatment and include provisions for the use of one ton chlorine containers and evaporators. This section of the plant when installed will be the most complete and modern in North America.

Recent experimental work carried out by Frank Hannan in the Filtration Laboratory may result in placing a new light on the real cause of taste in chlorinated water. Combined studies are at present being carried out by Frank Hannan in Toronto and John R. Baylis in Chicago, and it is hoped that the detailed results of their work will shortly be available for publication.

Table I below shows the chlorine and sulphur dioxide dosages. Table II shows operation and chemical costs.

Summary.—The average amount of water treated daily from June 13, 1927, to May 13, 1928, was 74.78 million Imperial gallons.

The maximum dose of chlorine applied during the super-chlorination period was 2.5 parts per million and the minimum 0.8 parts.

The maximum and minimum dose of sulphur dioxide was 2.0 parts and 0.8 parts per million, respectively.

The treatment was completely successful and a tasteless water was furnished to the consumers.

Super-chlorination provides a very high factor of safety.

The additional cost incurred by super-chlorination was approximately $0.78 per million Imperial gallons—$0.96 per million being the cost during ordinary chlorination.

The combined cost for sterilization and taste prevention treatment involved in maintenance and operation was $43,-360.37, equivalent to $1.74 per million Imperial gallons which is subject to material reduction through purchase of chlorine in 1-ton containers.

Ammonia or Permanganate in Conjunction with Single or Double Chlorination

Very probably there are instances in which ammonia, ammonia salts or permanganate treatment in conjunction with chlorination, for the purpose of taste prevention, have been applied which have not come to the attention of the author. The limited number of installations wherefrom data has been supplied will be reviewed without intent to ignore other cases.

London, England.—Sir Alexander Houston, Director of Laboratories, Metropolitan Water Board, London, England, has supplied the author with statements given below.

The following taste prevention measures are compared. (Note: The statements in quotation marks are actually those of Sir Alexander Houston taken from a recent communication to the author.)

1. Pre-ammoniation.
2. Chloramines.
3. Permanganate.
4. Super- and de-chlorination.

"The conditions under which chlorination has to be applied vary so greatly that it is not possible to lay down any hard and fast rule as to which of the above expedients is the best."

Table I—Showing Maximum, Minimum and Average Dose of Chlorine, Together With Maximum and Average Amounts of Sulphur Dioxide. Parts Per Million

Month	Chlorine: Slow sand plant Max.	Slow sand plant Min.	Slow sand plant Aver.	Chlorine: Drifting sand plant Max.	Drifting sand plant Min.	Drifting sand plant Aver.	Sulphur Dioxide De-chlorinating plant Max.	De-chlorinating plant Aver.
June '27	1.2	1.0	0.60	1.8	1.0	0.72	1.5	0.459
July	1.5	0.8	0.68	1.8	0.8	0.76	1.5	0.512
August	1.5	1.0	0.74	1.8	1.0	0.85	1.3	0.526
Sept.	1.5	1.0	0.82	1.8	1.0	0.96	1.4	0.634
Oct.	1.5	1.0	0.65	2.0	1.2	0.69	1.6	0.450
Nov.	1.8	1.0	0.65	2.5	1.2	0.73	1.4	0.441
Dec.	1.8	1.2	0.64	2.2	1.3	0.69	1.6	0.418
Jan. '28	1.8	1.5	0.514	2.2	1.5	0.58	1.6	0.336
Feb.	1.8	1.5	0.769	2.2	1.5	0.921	1.6	0.624
Mar.	2.2	1.5	0.975	2.4	1.5	1.17	1.8	0.832
April	2.2	1.5	0.941	2.4	1.5	1.05	2.0	0.745
May	1.5	1.5	1.8	1.5	1.5	0.447	1.2	0.315

NOTE: The average amount of chlorine applied when super-chlorination was not being practiced varied between 0.30 and 0.45 parts per million.

Table II.—Showing Maintenance and Operation Cost Figures, June, 1927-May, 1928

Chlorine, 94.95 tons	$13,231.57
Sulphur dioxide, 67.28 tons	13,519.60
Labor, 8 men	13,609.20
Maintenance and incidentals	3,000.00
Total	$43,360.37

Note: Cost of chlorine during this time was $139.50 per ton. Price of liquid sulphur dioxide in 1927 was $225 and in 1928, $162.33 per ton. Cost of chlorine in 1928 is $149.50, but the use of one ton containers will reduce the figure by approximately half. The "averages" above are not representative of the chlorine used for super-chlorination. The maximum and minimum figures are representative of the variations during super-chlorination only.

1. "In the case of pre-ammoniation, it is essential that the ammonia or ammonia salt be added to the water and thoroughly mixed with it before the chlorine is applied."

2. "The use of chloramines has the advantage of requiring but one point of application, but has the disadvantage that much of the chlorine required is lost in the reaction with the ammonia and the yield of chloramine does not seem to be quantitative. Di-chloramine appears to prevent the formation of tastes and sterilizes as well or slightly better than an equal dosage of chlorine."

"The Hampton (Kew Works) experiments go to prove that a simple chloramine process, i.e., mixing chlorine solution and ammonium chloride in solution in molecular proportions is practicable. In dilute solutions similar to those used in simple chlorination at least 75 per cent yield of chloramine is to be expected."

3. "Permanganate has the advantage of being capable of being applied either before, after, or simultaneously with the chlorine. A few experiments indicate relatively large dosages are required, but generally speaking it has proved effective in dosages of 0.24 to 0.96 p.p.m. It has the disadvantage of imparting color to the water, and therefore cannot be used successfully with waters of high organic purity."

4. "Super and de-chlorination is perhaps the most definite in preventing tastes and for rapid and effective sterilization. The process is perhaps best applicable to waters of high organic purity."

For details concerning the Metropolitan Water Board large scale practices with pre-ammoniation and permanganate treatment the reader is referred to the 20th and 21st Annual Reports of this Board[4].

In treating the Kew River water, during the winter months only, the supply receives pre-ammoniation continuously and permanganate of potash in addition whenever there is a probability that tastes may develop. Ammonia salts are applied at a point approximately 1 mile ahead of the chlorination and at a rate to provide 0.25 p.p.m. (NH_3) content. Occasionally permanganate is also applied at the chlorination station at a rate of 0.2 p.p.m. $KMnO_4$. Chlorine is applied at an average rate of 0.33 p.p.m. The treatment has met with complete success at a total chemical cost of 41c per million gallons.

At Hampton (Thames River) when the chlorine dosage was constant at 0.33 p.p.m., and ammonia was applied intermittently at a rate of 0.25 p.p.m. (NH_3), the results on the ammonia days showed that only one-half the number of samples contained B. coli in 100 c.c. portions compared with the number of 100 c.c. portions showing B. coli on days of chlorination without pre-ammoniation. The contact period available prior to sampling, however, was six hours, which period is essential to secure the full effect when ammonia is applied, unless the chlorine dosage can be increased.

Sir Alexander Houston in his various reports shows that use of chloramine, or pre-ammoniation, with chlorination reuqires a period of 4 hours if the most economical dosage of chlorine is to be effective. The contact period may be materially shortened by increasing the chlorine dosage.

In large scale experiments on the Thames water at the Kew Works the di-chloramine process of Harrold, (i.e., mixing chlorine water and ammonia solution or solution of ammonia salts in the ratio of 8 chlorine to 1.2 parts NH_3 prior to introduction into the water) was applied. On alternate days chlorine alone was applied and the results compared. With equal chlorine dosages after six hours contact the results were the same for chlorine as for di-chloramine but after 32 hours the chloramine results were superior.

If, as seems to be shown by the Metropolitan Water Board, large scale experiments, the di-chloramine process effectively sterilizes and prevents taste production, this process will be more attractive than pre-ammoniation from a cost standpoint.

The costly element is the ammonia and therefore the ratio of 1.2 NH_3 to 8 chlorine to produce di-chloramine is more attractive than the use of more ammonia in pre-ammoniation followed by less chlorine. For example:

Ammonia (NH_3) at 15c per lb.
Chlorine (Cl_2) at 8c per lb.

a.	Dichloramine (1.2 NH_3:8Cl) chlorine 0.5 p.p.m.	0.5 p.p.m. chlorine 0.07 p.p.m. ammonia cost per million gallons—42c
b.	Pre-ammoniation (chlorine 0.33 p.p.m.)	0.33 p.p.m. chlorine 0.25 p.p.m. ammonia cost per million gallons—53c
c.	Pre-ammoniation (chlorine 0.5 p.p.m.)	0.5 p.p.m. chlorine 0.25 p.p.m. ammonia cost per million gallons—65c

Greeneville, Tenn. (Softening Plant.)—Advice from J. W. McAmis, Superintendent of Water Commission, at Greeneville, Tenn., is to the effect that pre-ammoniation of the raw water at the rate of 0.25 p.p.m. ammonia and chlorination of the filter effluent continues to prevent taste development in the distribution system. The original report by McAmis[5] and a subsequent paper by the author[6] contain detailed information concerning the process.

Permanganate-Chlorine Applications

Rochester, N. Y. (Lake Ontario Water.)[b]—Under the supervision of J. M. Caird, Cons. Engr., permanganate treatment of the raw water at the plant of the Rochester and Lake Ontario Water Co. was begun in January, 1927, as a taste prevention measure. Apparently this is the first instance in America where the permanganate has been continuously applied. After more than a year of operation the permanganate treatment seems to be entirely effective in conjunction with pre-chlorination followed by secondary chlorination.

The permanganate is applied to the raw water almost simultaneously with the pre-chlorine application. The application is controlled by carefully watching changes in chlorine demand of the raw water. Increased demand indicates increasing organic content of the water which in turn indicates that polluted waters of the Genesee River are reaching the intake. This is a signal to begin permanganate treatment and to boost the pre-chlorine dosage to secure desired results. Change of winds which drives polluted water away from the vicinity of the intake allows for discontinuance of permanganate treatment, but a careful watch is always maintained to detect approach of the taste producing waters.

The following table indicates the periods of permanganate application and the rates applied:

Rochester, N. Y.
(Permanganate Treatment and Double Chlorination)

1927 Month	p.p.m. $KMnO_4$ median	maximum	Remarks
March	0.08	0.08	applied 12 days
April	0.06	0.09	15
October*	0.07	0.12	16
November	0.04	0.04	1
December	0.09	0.13	15
Jan., '28	0.05	0.14	11
February	0.05	0.13	17

*None applied between April and October.

Permanganate of potash in commercial grade costs from 18 ct. to 20 ct. per pound and may be fed from dry feed machines or solution tanks. The maximum cost for permanganate treatment at Rochester is 23 ct. per million gals. and the median cost has not exceeded 15 ct. per million gals.

Buffalo, N. Y. (Western New York Water Co.—Lake Erie Water.)[b]—The raw water is fouled by coke plant wastes which intermittently reach the intake. The only measure of purification is single chlorination which must necessarily be maintained at a relatively high rate.

Mr. H. F. Buy of the Western New York Water Co., a pioneer in chlorination of water, started permanganate application on January 16, 1928. The initial rate was but 0.03 p.p.m. which was thereafter varied to suit conditions as indicated in the tabulated data following:

Western New York Water Co.—Buffalo, New York
(Permanganate Treatment)

1928	p.p.m. $KMnO_4$			p.p.m. Chlorine		p.p.m. residual chlorine
	Min.	Max.	Aver.	Min.	Max.	
January	.03	.03	.03	.23	1.40	0.2 plus or minus
February	.03	.03	.03	.25	0.34	0.2 plus or minus
March	0.02	.48	.03	.19	2.10	0.2 plus or minus
April	.03	.08	.04	.29	0.50	0.2 plus or minus

In March serious pollution reached the intake as is evidenced by the high chlorine demand and permanganate required. Nevertheless it was possible to effectively sterilize the water without taste production. Apparently no complaints have been received relative to permanganate stains in the water. The particular interest here lies in the fact that chlorination has been called on to function alone where a filtration plant for some time has been considered desirable and is at this writing under construction. The results of the past season have shown what can be accomplished in chlorination of an unfiltered polluted water as a temporary expedient until more adequate purification measures can be secured.

Rensselaer, N. Y. (Hudson River Water).[b]—Experiments at the Rensselaer filtration plant during the past winter indicated permanganate application to the raw water effectively prevented taste production, and it will be again experimentally applied should phenol wastes become troublesome.

Chlorine in Algae Control

Chlorine will probably not entirely supplant copper sulphate as an algaecide, but it is becoming increasingly evident that it has a place in the field of algae elimination and has peculiar advantages in some instances that render it more desirable than copper sulphate. One for instance, is the accuracy of application to a flow of water past a given point, and another is the additional advantage which chlorination simultaneously possesses, i. e., sterilization and oxidation. The cost of chlorine is considerably less than that of copper sulphate and there is no reason for controversy in case some of the chlorine remains in the treated water.

The experiences of L. B. Mangun, Superintendent of Filtration, Kansas City, Kans., in the matter of algae control in a distribution reservoir wherein chlorination was employed in a novel manner will be thoroughly covered in a paper on the subject to be read at this meeting, therefore the reader is referred to Mr. Mangun's paper for the details and results secured.

New York City, N. Y.—Dr. Frank E. Hale, Director of Laboratories, Department of Water Supply, New York City, and also in charge of chemical treatment of the various water supplies of the city, has placed at the disposal of the author the following data on chlorine as an algaecide.

Chlorine dosage of 0.3 p.p.m. applied to the New York water supply attacks microscopic organisms and sets free the distasteful oils from several varieties of algae. Additional chlorine applied destroys the taste thus produced.

A dosage of 0.5 to 0.7 p.p.m. has destroyed and rendered tasteless 100 units of synura and above 0.7 p.p.m. 200 units can be handled. A growth of uroglena (2000 units) has been killed and taste destroyed with 0.5 p.p.m. chlorine, and dinobryon (500 units) has been destroyed and deodorized by 0.5 p.p.m. chlorine. The same dosage given a water entering a storage reservoir caused a 25 per cent reduction of organisms during storage whereas previously there had been a considerable increase. The organisms suffering reduction included asterionella, anabaena, aphanizomenon, coelosphaerium, tabellaria, melosira, volvox, and ceratium.

During the year 1927, chlorination of the New York Water Supply has controlled organisms and tastes as follows:

Synura . . (¾ units) dosage 0.3 p.p.m., residual 0.05 p.p.m.

Asterionella (1350 units) dosage 0.7 p.p.m., residual 0.2 p.p.m.

Synura . . (Croton supply) dosage 0.55 p.p.m., residual 0.1 p.p.m.

Synura (Long Island Ponds) dosage 0.3-0.5 p.p.m., residual 0.1 p.p.m.

In the well water supply of the Jamaica Water Co. crenothrix caused complaints. It was effectively killed in the system by a dosage of 0.5 p.p.m. (residual 0.1 to 0.3 p.p.m.) and blown off at the hydrants. It is sometimes the case that organisms are killed and taste increased as a result of small chlorine dosages, but for some reason the taste and odor dissipate during the passage of the water through the aqueduct and reservoirs.

Mexia, Texas. (Limestone Springs and Deep Wells.)—At Mexia, Texas, R. D. Morgan, Superintendent of Water Works, employs continuous chlorination almost solely as a means of algae growth prevention in service reservoirs. After various experimental applications Mr. Morgan advises that for best results the following procedure seems to be the most effective. Chlorine (about 0.72 p.p.m.) must be applied to the incoming water not less than 20 ft. ahead of a baffled mixing chamber constructed at the reservoir. At the mixing chamber inlet roughly 1.12 grains per gallon of hydrated lime are added. The effluent which enters the reservoir along one side near the surface creates currents which produce a very fair distribution of the incoming water containing 0.3 to 0.5 p.p.m. residual chlorine. Copper sulphate is occasionally applied to dead spots in the corners of the reservoir.

Prior to chlorination the Mexia reservoir was subject to rapid increases in algae growth after each cleaning and, in addition to the use of copper sulphate, in hot weather, weekly cleanings were necessary. After each copper treatment the water was filled with dead and decomposing algae which resulted in considerable complaint and damage at bottling works, laundries, etc.

Chlorination has been in use for almost two years and in a recent letter Mr. Morgan makes the following interesting statement: "We have had no trouble since starting chlorination and have not had to clean the reservoir for eighteen months." Thus it appears that the treatment which has stood the test of a part of one summer and an additional entire summer may be considered a preventive rather than a cure.

The author saw the conditions existing at Mexia prior to chlorination and the algae so abundant (protococcus) was apparently a copper resistant species[r]. Oscillaria was also abundant.

That chlorination effectively prevents the quantity and quality of growth formerly present in the Mexia reservoir is, to the writer's mind, a remarkable fact; but some credit is due the lime, for without it the efficacy of the chlorine, as reported by Mr. Morgan, was apparently not so great.

Chester Cohen, District Engineer, Texas State Department of Health, reports that in addition to Mexia the following towns in Texas are successfully using chlorine for algae control: Graham, Donna, Grand Saline, and Laredo.

At Richmond, Virginia, and Red Bank, New Jersey, chlorination pre-

vents growth of algae in the aeration and clear water basins.

Retardation or Prevention of Sludge Putrefaction in Coagulation Basins

Sludge deposits in coagulation basins at plants treating organic waters are subject to anaerobic decomposition. In summer and particularly so in southern climates gas production within the sludge deposits results in rising sludge which is sometimes referred to as "basin turnover." In Panama the basins at the Gatun plant, during the writer's service there, had to be thoroughly cleaned every fourteen days and at some seasons even more frequently, or else difficulties from sludge eructations occurred. These disturbances distribute ill-smelling and bad tasting decomposition products through the water.

At Elizabeth City, N. C., and Norfolk, Va., pre-chlorination has proven effective in improving the basin condition and in increasing the length of service between washings.

At Rusk, Cisco, and Henderson, Texas, where coagulation and clarification on the fill and draw plan in multiple tanks is practiced, chlorination of the coagulated influent during filling has proven effective in preventing rising sludge in the quiescent tanks.

Lake Dundee, N. J. (Passaic River Water.)—A filtration plant at the Lake Dundee plant of the National Silk Dyeing Co., was constructed in an attempt to purify the waters of the heavily polluted Passaic River which at times in summer resembles a septic tank in appearance. The plant effluent was intended for industrial use only. Trouble was experienced with putrefaction and liquefaction or gas lifting of sludge in the large coagulation basins. Upon the recommendation of Churchill Hungerford, Consulting Engineer, pre-chlorination was adopted to reduce putrefaction and frequency of basin cleaning. Sufficient chlorine is applied to the raw water to insure a slight residual in the basin effluent and from reports available the process is successful.

The author wishes to acknowledge with appreciation the cooperation, and assistance of the various persons mentioned in this paper.

References

1. H. W. Streeter—"Studies of the Efficiency of Water Purification Processes." Public Health Bulletin, No. 172, U. S. P. H. S.

2. J. S. Whitener—"Pre-Chlorination at Raleigh, N. C." Jour. North Carolina Section, A. W. W. A. Vol. 5, (1927), p. 101. Water Works, December, 1927, p. 504. American City, May, 1928.

3. N. J. Howard and H. E. Thompson—"Chlorine Studies and Observations on Taste Producing Substances in Water and Factors in Treatment by Super- and De-Chlorination." Jour. N. E. W. W. A., No. 3, 1926; Canadian Engineer, Oct. 19, 1926.

4. Sir A. Houston—20th and 21st Annual Reports to the Metropolitan Water Board, London, England.

5. J. W. McAmis—"Prevention of Phenol Tastes with Ammonia." J. W. McAmis, Jour. A. W. W. A., 17:3:341, March, 1927.

6. L. H. Enslow—"Recent Advances in Controlling Chloro-Tastes and Algae Development." Jour. A. W. W. A., 18:5:621, Nov., 1927.

7. Chester Cohen—"Chlorination for Algae Control." Jour. A. W. W. A., 17:4:444, April, 1927.

8. C. R. Cox—"Double Chlorination." Jour. A. W. W. A., 16:1:55, July, 1926.

Acknowledgment.—The foregoing is abstract of a paper presented June 14 at the 48th convention of the American Water Works Association.

Profit in Sewage Sludge

Municipalities that are struggling with the problem of financing successful operations of their sewage treatment works may be both interested and encouraged by the experience of Schenectady, N. Y., which sold its entire output of sludge for 1927, for use as fertilizer by farmers and gardeners in the vicinity. According to the June 15 Ohio Health News reports available do not indicate the price received, but if it was anything commensurate with the fertilizer value of the sludge, as compared with stable manure or commercial fertilizers, the aggregate return must have been an appreciable factor in financing operation of the plant.

Many Ohio municipalities are taking advantage of the sewer rental law for financing effective operation of their sewage treatment plants, and New York is without the advantages provided by that pioneer statute; but it is to be remembered that successful operation of sewage treatment works also includes sludge disposal, for accumulation of sludge frequently constitutes a disposal problem difficult of solution. Successful marketing of the sludge, therefore, not only would enable the attainment of 100 per cent operation, but also would pay its own costs and constitute a material reinforcement to the financing of plant operation.

Marion is the only Ohio municipality that markets its sludge. Floyd G. Browne, chemist-in-charge, began its sale about a year ago, and sales have reached a steady increase at $4 a load, of about a cu. yd. At Canton, Charles C. Hommon, superintendent of plant, pumps the wet sludge to a large farm owned by the city, and the success attained there has caused a heavy demand from neighboring farmers for similar service.

This is the fourth consecutive year that all the sludge from the Schenectady plant has been sold as fertilizer. Initial steps in an intensive sales campaign were taken in 1924. The demand has grown each year, and scores of prospective buyers have been unable to obtain the fertilizer, while others could not obtain the amounts they desired. The increased demand is noteworthy in view of the fact that few sections of the country report any interest on the part of farmers in sewage sludge, which usually is a liability instead of an asset.

Necessarily, a marketing plan must be adopted if the sludge is to be sold, and the business-like marketing methods employed at Schenectady could well be copied by other municipalities. The plant superintendent has given a series of lectures each year before farmers' meetings, has repeatedly obtained the aid of the county Farm Bureau, and also has maintained a program of publicity through the local papers. Every effort has been made to show farmers how to use the sludge to best advantage. Schenectady parks have been using it, and reports indicate excellent results on grass and flower beds. Beginning this year, sludge has been delivered in test quantities to two golf courses, and scores of bags have been given free to local householders for lawns and gardens. This distribution of sludge among the citizens has created much interest in the treatment plant, and favorable comment has resulted from the visits of persons who never before knew that the sewage treatment plant existed.

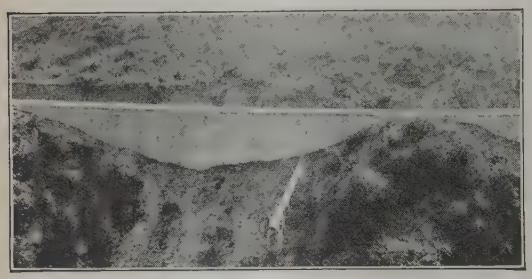
Care has been taken to inform users of sludge to keep it away from all types of crops growing in or on the ground which go to the table without cooking.

Bridge at Dusseldorf, Germany. This Steel Structure Was Widened a Year Ago by Bracketing on the Outside to Accommodate Two Street Car Lines. This Doubling of Capacity Was Secured at a Very Nominal Cost as the Bridge Had Been Liberally Designed

Drainage and Traffic Protection Provisions for New Boulevard in Pasadena

By W. E. BARNEY
Assistant Engineer, City of Pasadena, Calif.

The city of Pasadena has recently completed the construction of Linda Vista Avenue, one of its main boulevards, through the Linda Vista residential district which is located along the west bank of a wide canyon known as the Arroyo Seco and at the foot of the San Rafael mountains. This gives an additional outlet for traffic to the fertile San Fernando Valley via Flintridge, Sunland and Tujunga.



A Rather Unusual View of Linda Vista Boulevard at Pasadena. Note the Extension Put to the 30-In. Culvert in Order That Drainage Might Be Carried a Safe Distance from the Base of the Wall

A Portion of the Boulevard. At This Point Motorists Are Protected by 12-In. Reinforced Concrete Curb and Chain Link Highway Guard

A large portion of the construction required the making of heavy cuts and fills and provision for cross drainage from the adjacent mountains. For the drainage Armco corrugated culverts were used. In crossing Cottonwood canyon a 300-ft. length of 30-in. diameter pipe was placed through a fill 50 ft. in depth. To obtain street drainage, reinforced concrete catchbasins with curb instakes and Armco corrugated pipe wells connected to the 30-in. pipe were used.

At the north end of the boulevard and near the Devil's Gate Flood Control Dam another Armco pipe was carried through a reinforced concrete retaining wall. This wall, which was 440 ft. in length and varied from 3 to 50 ft. in height, was constructed along the west bank of the precipitous Arroyo Seco, the channel of which is from 100 to 125 ft. below the elevation of the pavement.

This wall is shown in one of the accompanying illustrations. In design the wall consisted of the L-shape, cantilever, and counterforted types and along the top Page highway guard was installed. The fabric was fastened to steel posts by No. 6 gauge wire clamps, the posts being grouted into steel pipe sleeves set in the curb which was constructed as a part of the retaining wall. Ornamental knobs were placed in the top of each post; both posts and fabric being painted white except the knobs, which were painted black.

That it was necessary to adequately protect motorists at this point is evidenced by the fact that even at this early date the chain link guard and curb has been called into service by a speeding car over which a driver had lost control. Without the chain link guard this car would have plunged to the sloping bank 50 ft. below.

W. C. Earle is City Engineer and Superintendent of Streets, J. H. Allin is Deputy City Engineer, and the writer designed the work. J. E. Haddock of Pasadena was contractor.

Simplification for Fire Apparatus Capacity Approved

A general conference of manufacturers and users, hold June 27th, at the Department of Commerce under the auspices of the Division of Simplified Practice of the Bureau of Standards, approved a tentative simplification for fire engine pumping capacities.

The recommendation as approved, is as follows:

*300 gal. per minute at 120 lb. pressure.

*400 gal. per minute at 120 lb. pressure.

500 gal. per minute at 120 lb. pressure.

750 gal. per minute at 120 lb. pressure.

1,000 gal. per minute at 120 lb. pressure.

Capacities marked (*) or any other capacities less than 500 gal. per minute are not recognized as standard by the National Board of Fire Underwriters. In this connection the following resolution was passed by the conference: "The conference goes on record as indorsing the paragraph contained in the suggested specifications for gasoline automobile fire apparatus of the National Board of Fire Underwriters, dealing with the 300 or 400 gal. capacity." This paragraph reads:

"These machines are within the reach, financially, of villages and rural districts which otherwise could not buy equipment; they are more generally effective than the usual chemical engine in territories without waterworks systems, as some suction supply usually can be found. It must be recognized, however, that in some states little or no credit is allowed by the insurance rating organization for pumping capacity of less than 500 gal. a minute in one or two pumpers."

On account of the relatively small number of fire engines produced annually, as compared with other manufactured products in the mechanical line, there has been a natural tendency toward diversification, in an effort to exactly meet the requirements of users, according to manufacturers represented at the conference. Manufacturers and users have recognized the fact that unnecessary diversity of size or capacity results in increased cost and slower service, and makes it difficult to manufacture parts for stock.

Approximately six months ago, a number of manufacturers cooperated to secure figures in regard to existing diversity, and after several preliminary meetings, a committee of the manufacturers formulated the list of standard capacities which was approved at the general conference June 27th, as being sufficient to adequately cover all reasonable demand for stock fire engines.

This recommendation will become effective on Oct. 1, 1928, subject to annual review by the Standing Committee. This committee will consist of Charles H. Meigs, Commissioner of the Fire Equipment Institute; George S. Watson, Chief, District of Columbia Fire Department; Ross B. Davis, President of the International Association of Fire Chiefs; S. O. Cook, of the Boyer Fire Apparatus Co.; and D. C. Fenner, of the Mack International Truck Corporation.

The Division of Simplified Practice will shortly circularize the industry for signed acceptances to the approved recommendation. Before the recommendation can be published by the Department of Commerce, at least 80 per cent of the industry, by volume of annual production, must accept the same in writing.

Annual Dinner for Officials.—Detroit has an annual Officials' dinner for those holding city, county, state and federal posts. The dinner is given under the auspices of the Board of Commerce. Nearly 450 business and public officials attended the 1928 dinner.

Dead Ends in Water Mains

Effect on Capacity and Quality of Water

By S. B. MORRIS
Chief Engineer, Pasadena Water Department, Pasadena, Calif.

IN order to find out the policy of other water works and to learn what progress their executives had evolved for meeting the problem of dead ends, I wrote a note to eight of my friends in the water works fraternity. Their replies were unanimously opposed to the mainteance of dead ends wherever they could possibly be eliminated. Everyone provides a fire plug or blow off to bleed the dead ends of mains unless an active service can be placed at the extreme end of the main.

Practice of blowing off these bleeders varies. Some blow them off at fixed intervals of two weeks to two or more months; others bleed them only upon complaint or at irregular intervals as experience dictates. When dead ends are caused by valves being closed between pressures one large city makes a practice of cracking these valves sufficiently to cause some circulation from the higher to the low pressure.

Replies to my letter show that not all are agreed upon what the real source of difficulty is with the dead ends mains or the sealed services which present somewhat the same problem. Mostly the trouble appears to be with the taste and odor of the water due to products of bacterial action. One city engineer attributes this taste to the pipe or the pipe dip; another engineer believes the corrosion due to gasses formed is the greater problem.

In the short time allotted to me I shall attempt to briefly analyze and weigh the several problems pertaining to dead ends in water mains and sealed services.

Dead ends affect the carrying capacity of the mains for general and fire purposes. The stagnant water in dead ends causes tastes and odors and may affect the rate of corrosion of the pipes. Different metals used in the manufacture of the various kinds of pipe effect the water differently, and in turn the pipes themselves are affected differently by different qualities of water.

Effect on Capacity.—The undesirability of dead ends from the standpoint of main capacities for general and fire purposes is immediately evident. For the same sizes and lengths of pipe the dead end main will have not more than one-half the capacity of the circulating main and will be twice as subject to interruption or failure of service through being supplied from but one end. Water pressures will fluctuate more widely and water hammer is more severe in the dead end main. The circulating system tends to equalize pressures and drafts by spreading of the load factor.

Effect Upon Quality of Water.—In discussing the effect of dead ends upon the quality of the water served to the consumers, it is well to consider just what chemical and bacteriological reactions take place. The average city water contains more or less dissolved oxygen, organic matter, acidity or alkalinity.

The dissolved oxygen is rapidly consumed either by bacterial action or oxidation of the interior surface of the pipe. Aerabic types of bacteria must then die off entirely unless they are able to form spores which would continue only as spores. Anaerobic bacteria, however, will thrive and their numbers at any moment will be determined by the available organic food supply present.

The activities of aerobic bacteria are not productive of such especially bad odors and tastes as the anaerobic. It is to this latter class of organisms that we must attribute the worst dead end conditions. Normal laboratory procedure is effective only for aerobic types of bacteria and these at the body temperature of 37° C. Anaerobic bacteria grow better at 20° C.

When bacteria consume organic matter in the presence of oxygen the reduction products which they form are not objectionable and possess neither taste nor odor. When bacteria work upon the same types of organic matter in the absence of the all important dissolved oxygen the decomposition products which they form are foul smelling. Such products as hydrogen sulphide and other highly odoriferous sulphur compounds are formed.

While none of these products which give to stagnant water its characteristics odor are at all dangerous to the health, they are at times the source of such complaint by the consumers and a disturbing problem to the water superintendent.

Probably most true dead ends have little or no circulation though chemotaxis may play a part for we know that most bacteria will move toward available food. As the organic matter in the dead end becomes depleted, there may be some movement of the bacteria from the dead end toward the portion of the pipe where water is in motion and a fresh food supply is available. Such movement or circulation is not thought to be appreciable.

Tests made of active and sealed services from the end of the same 2-in. cast iron lateral show little or no apparent contamination of the active service.

What Tests Show.—I am much indebted to George Read, Superintendent of Meters and Services and to Carl Wilson, Director, Biological Laboratory for the Bureau of Water Works and Supply, Los Angeles, for many analyzes of water from scaled services and able discussion of the biochemical problem. The results of these tests and other analyses conducted in our own laboratories at Pasadena show widely varying conditions from which some general statements may be made.

In any given dead end bacterial action will increase rapidly until oxygen and organic matter are consumed after which the bacterial action will rapidly diminish to a very low condition. Foul gasses will begin with the failure of the oxygen supply soon reaching an optimum after which they will cease to be produced with the lessening bacterial action. Tests by Dr. Wilson indicate lesser bacterial action in sealed copper services than in sealed cast iron services, which may be due to germicidal action of the copper, though insufficient tests have been made to be conclusive.

Therefore we cannot expect any certain fixed time of flushing such, as every two weeks, every month or any other inflexible period to be proper for every water system, nor for every dead end in the same system. In fact, in almost every system the quantities of oxygen, carbon dioxide and of organic matter are so variable with the season and with the several sources of supply that only experience in the individual case can be used as a safe criterion. We are quite safe in saying that a very old dead end which has not been flushed will no longer require any flushing as bacterial action has practically ceased and the obnoxious gases are no longer produced.

Effect of Dead Ends Upon Corrosion.—There appears to be a general opinion that dead ends or sealed services are much more rapidly affected by interior corrosion than pipes through which water is constantly moving, A theoretical discussion of the active elements of corrosion, and observation of many sealed services in comparison with active services does not appear to sustain this opinion.

The most active corrosive elements in the average city water supply are: Dissolved oxygen, which we have seen is rapidly used up and does not re-

place itself; free carbon dioxide or carbonic acid, which may not in itself be used up, but which cannot continue to be active or effective without oxygen, and hydrogen-ion concentration. Hydrogen-ion concentrations represented by values of pH greater than 10 are only slowly corrosive, between pH 4.3 to 10 moderately, and less than pH of 4.3 rapidly corrosive. Here again oxygen must be present to break the polarizing film of neutral hydrogen stems on the metal to complete the corrosive action under the electro-chemical theory of corrosion.

We have not time here to go more fully into the detailed theories of corrosion and the effect upon the several metals now used for mains and service piping. Inspection of services in our Pasadena system varying from 10 to 41 years of age in both sealed and active condition appears to substantiate the fact that interior corrosion is not more rapid for the sealed service than for the active service and may be materially less, due to the absence of dissolved oxygen.

It would appear that frequent flushing of dead end mains may materially add to the rate of interior corrosion over that to be expected if the mains were not flushed. The optimum rate of dissolved oxygen and carbon dioxide for maximum corrosion may be brought about for a greater percentage of the time through such flushing than though the dead ends were allowed to reach their inactive condition through complete consumption of oxygen and other corrosive elements.

Effect of Electrolysis.—Dead end mains and services are naturally more subject to electrolytic action from stray street railway currents. If such dead end pipes or services are positive to the earth in the direction of their dead ends, currents will flow from them into the soil, thus concentrating corrosive action near the ends of such pipes.

From the above discussion we must conclude that dead ends are something we should restrict to an absolute minimum in any modern water works distributing system, for such dead ends tend to decrease pressures, lessen fire flows, increase shutdowns, increase water hammer, increase complaints of tastes and odors, in some cases they may increase corrosion, particularly from electrolysis. The growing use of duplicate mains on each side of a street should make the number of dead ends between pressure districts less necessary. In fact this is an additional argument for such duplicate mains.

The practice of locating fire plugs on dead ends as effective bleeders for the mains is desirable in flushing the pipe lines, but not so satisfactory from the standpoint of fire protection.

Cracking of valves between pressures to give a slow circulation from the higher pressures to lower ones is a hazardous procedure as far as the valve is concerned. A better procedure where such circulation is necessary, would be to install small by-pass valves for this purpose.

For average water conditions sealed services should present no greater problem than active services. Where severe conditions are known to exist, sealed services can be installed with the corporation cock at the main closed, and a valve box installed over such cock so that the service can be turned on when required. In this way water is not turned into the services until it is to become an active service. This is the present practice in some cities.

Acknowledgment.—The foregoing is from a paper presented at the 1928 Convention of the American Water Works Association.

Public Service as a Profession

The following interesting article pointing out the need for trained men in modern city administration is taken from the Toledo City Journal, a publication of the Commission of Publicity and Efficiency of Toledo, O.:

"To the victor belongs the spoils." This trite quotation, often attributed to Andrew Jackson, originated with Senator Marcy of New York. But the spoils system was flourishing in New York city over a decade before Jackson was elected president in 1828. It grew unchecked for over half a century, when, in 1883, the first national civil service law was passed. Since that time civil service has made considerable progress in cities, and today Indianapolis is the only city of over 250,000 inhabitants without civil service provisions. However, in many of these cities it is a dead letter.

Foundation of the Machine.—What is the theory underlying the spoils system? It is based upon the idea that all men are created equal and are equally able to fill public office. It is the foundation of the political organization and the "machine." Assuming all men of equal abilities, and conceiving all public offices and positions as political plums, it is but a step to the idea of rotation in office, giving little Jack Horners a chance to stick in their thumb and pull out a plum.

Is the spoils system inseparable from government? Is there any inherent reason why the public service should not offer a permanent career just as law, medicine, or business do? It may be said at the outset that the spoils system is purely American. It is unknown in England and German city administration. City councils come and go, but there administrative jobs are looked on as a trusteeship for the public, and not as a privilege of the office-holder. In Europe professional qualifications are considered the first requirement for the people in the administrative service. In American cities the first question usually is, "What did you do for the party?" And just so long as the American public demands nothing more of its public employes than it be loyal party supporters, it need not expect the efficiency of private business.

Complexity of the Job.—It may have been true that almost any man could fill any office capably in 1800, when keeping pigs off the public thoroughfares was one of the pressing problems of the community—when there were no sewers, no public street lighting, no public water supply, no crime problem, no traffic problem, and no street pavement except a few cobblestones. But the good old days are no more. Times have changed. Today the chief executive of the modern city is confronted with a varied array of problems that would stagger the head of the largest industrial concern in the country. From street railways to vice, and from water supply to playgrounds, from anonymous letters to job seekers, from municipal universities to street cleaning, the variety and complexity of the problems confronting the modern city executive is bewildering.

Trained Men Necessary.—There are few departments of city government that do not demand experts. Do American cities get and keep professionally trained administrators? The question answers itself. With the exception of a few departments, such as engineering and law, faithful party diligence is the main requirement of a public employe.

Why are there not more trained men in the service of the city? There are several reasons for this condition. In the first place, with a few exceptions, the best brains of the city are engaged in business and the professions. And why? Ask ten successful managers and professional men why they did not enter the public service and you will receive some such replies as these:

"The public service does not offer a career. A job depends on the political favor of the group in power. There is no assurance that the job will last more than two or four years if my political opinions do not tally with the electorate or the appointing authorities. There is no opportunity to transfer to a similar job in another city or state if I show superior ability. The attitude of the public towards public office-holders is one of indifference or contempt for the people 'feeding at the public trough.' And last, but not least, salaries do not compare with those offered in private employment for jobs demanding similar talents."

Changed Attitude Needed.—American government and especially American city government has undergone a revolution in the last century. The public is demanding more and better technical services of the cities. Yet the attitude of the electrorate has changed little toward public employes. Until it is realized that adequate and efficient public service demands trained experts instead of expert politicians, the city dweller will not get an adequate return for his taxes.

Factors That Must Be Considered in Valuing Real Estate

Considerations in Arriving at an Equitable Tax Assessment

By LEE I. HECHT
Associate Judge, Appeal Tax Court, Baltimore, Md.

WHAT the fairminded taxpayer wants is fairness and equality to all, and that each and every citizen, whether the owner of only his small home or of property belonging to one of our major corporations, is entirely satisfied when he or they realize that no preference whatsoever is being shown, but that all property is assessed on the same basis. A practice which has greatly improved the taxing system is to delegate a particular assessor and his assistant to a district with which he must familiarize himself and review annually, so that the taxpayer promptly receives the advantage of any change in conditions. The ordinary assessor endeavors to be fair and has no interest beyond that of seeing that all taxpayers, and they, of course, contribute to his salary, are treated on the same basis.

No Set of Rules Applicable to All Conditions. — Conditions in various communities are so vastly different that it would be hard to lay down a set of rules that would be applicable in all cases; and, therefore, there must be careful investigation and consideration given to local conditions in arriving at conclusions that would assist in appraising property for taxable purposes. The law in our State provides that property must be assessed at its fair and reasonable value. So frequently people get the idea that they are assessed 50 per cent or 66⅔ per cent of the value of their property. Should any such practice be followed, no one would gain any benefit because the same advantage would be given to each and every taxpayer, but what we endeavor to find is a fair value of the property. Now, what is value of the property? Certainly it is not selling price when forced by foreclosure or other public sale, but what price the property will bring at private sale, though no force be back of the sale. Of course, when property is sold and particularly when bought by a successful real estate operator, the impression very frequently goes out that it was bought cheaply and that if Mr. So and So paid a certain price for it, surely it is worth more. In fact, during the boom days, frequently prices pyramided in that a resale occurred on the strength of the operator who originally bought the property. This brings to mind a certain incident when I was attending an auction sale of valuable personal property at a nearby resort. A lady who had lost her pocket book in the crowd, which pocket book contained $100, promptly made her way to the auctioneer and instructed him to advise his audience of her loss, and to offer a reward of $50 for the return of the pocket book and its contents. Immediately after the auctioneer made the announcement, a zealous business man who was sitting in the front row of the auction, promptly arose to his feet and bid $75 for the return of the pocket book and its contents. So in real estate when one buys, even though the property may have been for sale for quite a long time, it immediately reminds another prospective purchaser that they have lost an excellent opportunity of getting a real bargain.

Elements in Connection with Values. —Again referring to value, we must consider several elements in connection therewith: the original cost, the selling price, going concern value, replacement value, income value, loan value, sentimental value, market value, cash value and possibily social value. These factors and possibly some additional ones must be taken into consideration in appraising for taxation of real estate.

In assessing a new building, where we have the original cost, it is most fair to assume that the contractor built it as reasonable as an ordinary prudent person could have built the same, particularly after competitive bids had first been secured; and, therefore, it is fair to assume the cost to the owner when the building is completed as a fair and reasonable cost; nevertheless, it is only right and proper to make a deduction of say 10 per cent from the total cost, which will cover commissions, bonuses, and certain exceptional and extraordinary fees, and by deducting the said 10 per cent a fair and reasonable value of the property is obtained. This gives us a fair price for the purpose of taxation.

Selling Price of Property.—Now, as to selling price of property we, of course, cannot take one particular or isolated sale where for some personal reasons the person may have paid more than the actual worth of the property, but upon having several private sales in a block or neighborhood of similar property it is most fair to average the several sales and in this manner ascertain the real value of the particular property in that neighborhood. In this connection I might inject at this time that where rows of houses are built, all of the same construction and design, containing the same number of rooms, that each and every one of the particular properties in the block must be appraised and, of course, assessed precisely at the same value. Corner properties of blocks most naturally have advantages which other properties of the same block do not have; and, therefore, the corner influence must be considered in arriving at the value of the same.

Going concerns, particularly of manufacturing concerns, have a much greater value than similar properties of non-going concerns, and wherein the said properties have been vacant and their utility wanting for a period of time.

Replacement and Income Values.— Replacement value is a serious proposition, especially wherein we must consider the added cost of building today as compared with the cost of building in years gone by, and wherein it is necessary to replace a building and the valuation for taxation is considered on this score, certain allowance must be made and provided for depreciation from the cost of replacement today and the cost of the building that was established in years gone by.

Income value applies in various ways as to the different classes of property. An illustration is offered of apartments wherein the owner must provide in some instances janitor service, elevator service, as well as heating, while in others only heating and no additional service is given. In the former class I believe that a gross income of 22 per cent to 24 per cent should be allowed for, assuming all apartments rented, in arriving at a fair value of the property, especially considering this element. While in apartments of the cheaper class, where only heat is provided and no modern refrigeration such as most apartments now furnish, then I believe a capitalization of from 18 per cent to 20 per cent is ample and fair to the parties of interest.

Let us also at this junction stop and consided the income value received from stores and retail establishments in general. When leases are made for such properties the amount of taxes that the owner is then paying is taken into consideration when entering into the lease, and an excellent provision

which is usually incorporated in leases, and which, I might add, should by all means be made a part of the same, is that any increase in taxes whether by assessment or rate should be borne by the lessee, and if this provision is provided for, then I feel that a fair return in assisting in arriving at the value of the said property, considering the income of the same, is 10 per cent to 12 per cent. Office buildings provide another class of property that we must give special consideration, and the rate per front foot that other buildings in the same community and particularly in the same neighborhood are charging and receiving, and the amount of space occupied must first be considered. Assuming that the building is filled and that there is a demand for similar space, I believe that a return of 10 per cent to 12 per cent on the income when service such as is given in the modern office building is provided is fair and reasonable.

Sentimental and Social Value.—Sentimental value is something that must be seriously considered, for restrictions are frequently provided for in properties, which restrictions have the effect of maintaining among a certain class of persons the value of the properties in that particular section. This applies in most instances to developments of the better class, and also we might consider sentimental reasons which frequently have the effect of having the property sell for more than it is really worth, when a person is willing to pay more than the actual value of the property solely because they want to reside next to a relative or close to a school, or for some extraordinary or exceptional reason. If sentimental reasons give an exceptional or extraordinary value to the property, then this value should not be considered by the assessor in appraising that property for taxable purposes.

Social value is analogous to sentimental value and should not be considered too strongly in arriving at a conclusion as to the value of the property.

Cash value is the value on which we should base our appraisement for taxable purposes, and when a person who has just purchased a property secures a fair and reasonable loan in the way of a mortgage on the same of 60 per cent or 65 per cent of the value of the same, it should have no effect as to helping to place the value on the property, because such a loan is an investment to the one from whom the money is secured and must be considered in the same category as a cash sale.

Valuation of Land and Improvements.—Another most important thought and one that I desire to call your attention is the difference between the valuation of land and improvements. After establishing the unit value of land in any particular block, all land in that block is assessed at precisely the same value per front foot, but, of course, additional value for corner influence. This method is fair to each and every owner wherein each and every front foot having the same depth is assessed at precisely the same value. Improvements cannot always be appraised with the same degree of certainty that we appraise land, because it is manifestly apparent that even though improvements appear to be the same, they are frequently quite different when thoroughly investigated. Land when unimproved does not have the same value as when improved, and I personally feel that unimproved land should be increased 33⅓ per cent when improvements are made upon the same, said improvements, of course, to be of a definite and permanent nature.

Acknowledgment.—The foregoing is an abstract of an address at the recent annual convention of the National Association of Real Estate Boards.

Sterilization of Tunnel Shafts

Chlorine is used by the city of Chicago for the sterilization of shafts of water tunnels which have become polluted by leakage from sewers.

The chlorination of shafts has been resorted to as an emergency measure on several occasions. Whenever "live" sewers adjacent to water tunnel shafts are being repaired or replaced to correct leakage into the shafts chlorination has been advised because of the relative rapidity with which pollution at the surface of the shaft may be carried down and contaminate the water passing through the tunnel. Studies on the time of penetration and the circulation of water in shafts of various depths have been made, using a salt solution and an electrical apparatus with a sensitive millivoltmeter to record the presence of this solution at various points in the shaft.

The method of chlorinating shafts is to connect a hose by a special fitting directly to a chlorine tank and lowering the hose to the bottom of the shaft. The gas is then turned on at a rate sufficient to prevent frosting of the tank and the hose raised gradually at a rate of about 2 ft. per minute. This practice has proven effective and practical and has been very helpful in connection with the tunnel pollution work.

New Jersey May Eliminate Cross Connections.—The State Board of Health of New Jersey will consider at its next regular meeting a proposed amendment to the state sanitary code, having for its object the elimination of pipe line connections between approved public potable water supplies and unapproved sources. Chief Engineer H. P. Croft has submitted to the state board a report recommending an effective change in the sanitary code, prohibiting the installation of new cross sections or by-passes between approved and unapproved sources of supplies. He also recommends the abolishment of existing conections before a given time, unless they are all of a modern type, readily made accessible for inspection. In such circumstances the report suggests the granting of temporary permits, renewable annually by the State Board of Health.

Method of Sterilizing a Tunnel Shaft by Chlorine; Also Shows Deep Sampling Apparatus for Obtaining Bacteriologic Samples From Shaft

The Protection of Impounded Reservoirs

Results of an Investigation of Recreational Activities

By HELMAN ROSENTHAL
Director, The Dallas Laboratories, Dallas, Tex.

THE writer has had the privilege of observing for several years the water from lakes in Dallas. The city has four sources of supply; deep artesian wells (which supply only part of the city), Elm Fork of the Trinity river, a small reservoir containing about 700 million gal. of water, and a larger reservoir containing about 5 billion gal. of water. The latter reservoir covers an area of about 1,500 acres and has a shore line of about 12 miles. Drainage from the surrounding country (which includes a number of dairies and one or two trash dumps) enters the lake; hunting and fishing in season is permitted, and no restrictions on boating. Bathing is not permitted, but undoubtedly a few mischievous boys could be found in the lake on a great many occasions.

That part of the city of Dallas which uses chemically treated water consumes about 14,000,000 gal. per day, 8,000,000 gal. of which comes from Elm Park and Bachman lake, and about 6,000,000 gal. from White Rock lake.

The latter lake was opened about 1910, and as stated above, boating, hunting and fishing are permitted; also considerable drainage from a few dairies gets into the lake. At no time, however, has the pollution either from the smaller or larger lake been so great that careful treatment would not produce an A-1 effluent.

The Questionnaire and the Replies.—The whole problem simmers down to the question, what is the limit of pollution that can be handled safely and economically by the various processes of purification at our command? The writer has sent out the following questionnaire to a number of waterworks men throughout the country:

1. What is the average count on Agar at 37 deg. C., 24 hours?
2. What is the average B. Coli content per 100 ml.?
3. What is the highest Agar count ever obtained?
4. What is the highest B. Coli content per 100 ml. ever obtained?
5. What is the average Agar count and B. Coli index in final effluent?
6. What is the average Agar count in tap water?
7. What is the B. Coli index of city tap water?
8. Under the most adverse conditions have you any trouble in meeting the treasury standards for pure water?

Answers were received from eleven cities, and since I failed to ask permission to use their names, I will just call them A, B, C, etc. The answers are summarized in Table I. The information regarding recreational activities follows:

A. City of about 900,000; water treated and filtered.

"My personal opinion is not to allow hunting, fishing and boating on the water shed, as there is a potential danger of a typhoid fever outbreak, which would be very hard to check. I am greatly in favor of keeping the public away from the water shed."

B. City of about 1,000,000 population; water treated and filtered.

The superintendent of filtration does not advocate hunting, boating and fishing, and has the following to say:

"It has always been my opinion that these sources of supply should receive the greatest amount of protection because while it is not the usual thing to suffer any pollution, there are rare occasions when epidemics of appreciable size are caused through carelessness."

C. A city of 800,000 population.

The superintendent has this to say:

"Regarding the matter of boating and fishing in our reservoir, we have never allowed hunting, fishing or boating on our property. We control 8,000 acres which we have made into a state game preserve."

D. A city of about 450,000 population.

The bacteriologist from D. had the following to say:

"Personally, I can see no objection to permitting hunting and fishing on a raw water reservoir on a large size reservoir."

E. A city of about 135,000 population. Water unfiltered and comes from impounded reservoir.

The city chemist of the city of E. states the following:

"With reference to boating, fishing, and hunting on watersheds, we have permitted these at ———— lake and up to the present time have had no trouble. I see no objection to the practice so long as it is properly controlled."

F. A city of about 160,000 population. Infiltration Galleries.

Regarding hunting, boating, and fishing, the chemist at this water works has the following to say:

"Owing to the fact that our water is collected entirely by means of infiltration galleries, we have no storage or impounding reservoirs—and therefore, feel that our experience or opinion on this matter would not be of much value to you."

G. A city of over one million population.

The city engineer of G. who answered the questionnaire states:

"Although we are not familiar with local conditions at Dallas, as a general rule this department does not favor the use of water reservoirs for recreational purposes."

H. A city of over one million popu-

Summary Table Showing Results in a Number of Cities in the United States

City	population estimated	Highest Agar Count 37° C. 24 hrs. 1 ml.	Highest B. Coli per 100 ml.	Average Agar Count 100 ml.	Average B. Coli per 100 ml.	Agar Count tap water 1 ml.	B. Coli per 100 ml. tap water	Water treated and filtered	Water chlorinated but not filtered
A.	900,000	70,000	100,000	300	600	0.1(?)	0.3	yes	....
B.	1,000,000	.....	.....	33	.....	2.	.....	yes	....
C.	800,000	31,000	1,000	175	750	2.	0.1	yes	....
D.	450,000	31,000	100,000	2,200	2,000	.....	1.	yes	....
E.	135,000	1,800	100	280	15	100	practically 0	no	yes
F.	150,000	50,000	10,000 (do not make lower dilution than 0.01)	1,901	3,300	0.81 (?)	practically 0	Infiltration galleries	?
G.	over 1,000,000	81,000	30,000 (McCrady No.)	584	40.8 (McCrady No.)	7	0.051 (McCrady No.)	no	yes
H.	over 1,000,000	.....	10,000	343	699	5	0.6	no	yes
I.	800,000	94,000	60,000	9,700	2,470	*380	1	yes	....
J.	160,000	over 10,000	.....	218	2,926	14	1.19	yes	....
K.	300,000	rather high	rather high	.....	.....	below 100	below 1	yes	....

*This high count due to passage through open clear basins and after growth. The effluent from the plant has an average count of only 23.

lation. Water chlorinated but not filtered.

The commissioner of the city of H. states:

"Boating and fishing is permitted in most of the lakes and reservoirs which constitute ———— water supply."

I. A city of about 840,000 population. Water treated and filtered.

The following is a statement made by the chief chemical engineer:

"Where water is to be treated and filtered, I can see no objection to fishing and hunting on the watershed. In district where no treatment of the water follows storage no such use of the watershed should be maintained and the hunters and fishers should be notified of the proper disposal of all waste and litter."

J. A city of about 160,000 population. Water treated and filtered.

The chief chemist of J. further states as follows:

"We have several small cities and villages on our watershed which contribute very largely to our raw water contamination. In your case I would say that only fishing, hunting and boating would do you little damage."

K. A city of about 300,000 population. Gets its water from a river. Water is treated and filtered.

No definite answers but to my personal knowledge this water will run very high both in count and in B. Coli. Boating, hunting and fishing is permitted, but not swimming, and this city has rarely to my knowledge ever failed to comply with the Treasury Standard.

In Dallas, as stated before, we are obtaining water from two lakes; one fairly good size containing approximately 5 billion gallons; the other containing only about 500 million gallons. In both of these lakes hunting, boating and fishing are allowed. Furthermore, there are a considerable number of camping sites on both lakes and they of course contribute to the pollution. Yet, the bacterial count as well as the B. Coli are very much less than our river water, hardly ever running over 100, most of the time considerably less than 100 B. Coli per 100 ml. We have not had at any time that I have had charge any trouble in producing a water considerably better than the U. S. Standard.

Studies of U. S. Public Health Service.—In my opinion the only criterion whether hunting, boating, and fishing or even bathing should be permitted is the load that the water purification plant can safely and economically handle. This is a problem that still needs solution. The work done by the U. S. Public Health Service on the Ohio River is of considerable value but in my opinion still insufficient in drawing definite conclusions.

In the review of Mr. Streeter of the U. S. Public Health Service, he states that the primary object was to study the limits of raw water pollution which are consistent with the production of effluents conforming to accepted standards of bacterial quality, having reference to water purification plants of the type found along the Ohio River and on other similar river systems serving as sources of purified municipal water supplies.

The secondary objective was to evolute the different facts subject to the control of the plant operator, which influence, directly or indirectly, the cost and bacterial efficiency of water purification.

The conclusions reached by the experiments at experimental plant at Cincinnati were as follows:

"That an orderly relationship exists between the bacterial quality of raw water and effluent—virtually unaffected by seasonal changes as raw water turbidity."

"The indicated maximum limits of raw water B. Coli are 100 per ml. for unchlorinated and 5,000 per 100 ml. for chlorinated water."

He states "that these conclusions, however, are subject to qualification pending further studies of other factors which have a decided bearing, in contrast with those which are involved in the purification of turbid river waters, such as exist in the inland streams of the United States."

Summary of Replies to Questionnaire.—Summarizing we find the following: All the answers with the exception of J. assert they never have any trouble in producing a water which meets the U. S. Standard. Even J. which states that they sometimes have trouble, have an agar count of only fourteen and a B. Coli index of 1.19 per 100 ml. In other words, it seems that almost regardless of pollution good results can be obtained. Please understand that I am certainly not advocating indiscriminate pollution; I am merely trying to analyze the situation in an unprejudiced attitude of mind with the hope that we can arrive at something definite.

It may be argued that it would be ideal to eliminate all possible pollution from our raw waters. Such a condition even if desirable, would be economical. In this connection it must also be remembered that there are vast areas in the United States that have no large bodies of water and to deny the citizenship the use of same is to deprive them of something very essential to their well being.

Conclusion.—In conclusion, I wish to state that in my opinion we can allow freer use of large reservoirs, provided certain precautions are taken, than has been hitherto thought advisable. Especially is this true where lime is used in the treatment, and chlorination is resorted to. It of course, also means that the man in charge of the Water Purification Plant must be capable, and know at all times the kind of raw water he is getting and the quality he can produce. He must be able to interpret results and know how to apply the facts gathered. He must know something about the factor of dilution, the effects of sedimentation both in the reservoir itself and after the treatment with the chemicals, and other data which will aid him in his decisions.

As mentioned before, there may be some additional cost in treatment of polluted raw water, but the additional cost involved in producing a safe effluent should certainly not cause the community to legislate against the use of the watershed or the water itself. Someone, whose name escaped my memory, well expressed it—"So long as we huddle ourselves together in large cities, we must pay the penalty of concentration." Where water is a scarcity, people have a right to demand that they be allowed, at least, limited use of the water and at the same time demand from the men in charge of the purification plants to produce an A-1 effluent.

Acknowledgment.—The above is an abstract of a paper presented at the 1928 convention of the American Water Works Association.

X-Ray to Be Used for Finding Defects in Trees

The Eastman Kodak Co. is conducting experiments in examining trees with the X-Ray to discover defects and estimate their seriousness and extent. The danger of allowing seriously defective trees to stand may be eliminated by the X-Ray if the experiments work out successfully, according to the research laboratories of the Eastman company. The X-Ray may also prove valuable in saving trees which might be cut down on suspicion of being unsafe. X-Ray examinations can be used on wood poles supporting telephone and electric lines as well as on living trees.

The X-Ray examination of trees and poles gives much more information than the ordinary method of inspection, according to Eastman company officials. It is believed that cities and public service corporations, who may be subject to heavy damage suits from falling trees or poles, as well as commercial tree surgeons, will be interested in the X-Ray examination of trees.

X-Rays have already been used in examining raw wood and wood structures for defects. One important instance of this has been the inspection of the wood parts of airplanes.

X-Ray photographs of 1-in. slabs cut from decayed trees have been made by the Eastman company and show a great deal of interesting detail. It is believed the X-Ray examinations will be useful in the study of the structure of tree decay.

St. Louis to Vote on Airport.—A special election will be held at St. Louis, Mo., to vote on a $2,000,000 bond issue for a new airport.

Water-Cement Ratio Proportions On City Paving Job

Methods at Lawrence, Kan., Described in Kansas Municipalities

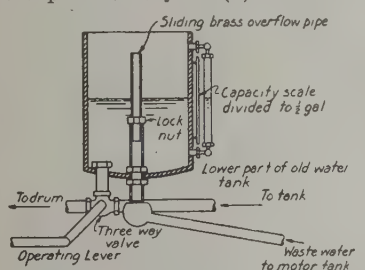
By C. T. HOUGH and HOLLAND WHEELER
City Engineer and Construction Engineer

DURING the past season, the engineering department of the city of Lawrence, Kan., used the water-cement ratio method of designing concrete mixes for city paving, to try its practicability.

Mixes Designed Under Old Specifications.—The main difficulty at first lay in the 1:2:3½ mix specification, drawn up before the pre-determined strength method for mixtures was contemplated. This was brought to the attention of the city commission and a special meeting was called to devise a plan by which water-cement ratio could be used on the summer paving program. After deliberation it was decided to design water-cement ratio mixes under the old specification. These mixes, however, were to aproach very nearly the same volume as the 1:2:3½ mix, which meant that the 3,000-lb. strength recommended for paving work must be exceeded in some instances. The following restrictions were also placed. (1) No mix, based on dry, rodded volumes was to exceed 1 part cement, 2.2 parts fine aggregate and 3.6 coarse aggregate. (2) The cement factor for 1 sq. yd. of 7-in. concrete was to approach very nearly 1.17 sacks. Some of the designed mixes exceeded the above proportions and in some cases mixes were reduced arbitrarily to meet requirements. At the close of the season, however, the excellent results obtained showed that the restrictions placed by the commission were very fair and sound.

Extra Equipment.—The contractors handling all of the season's paving work were Penny & Baldwin of Ponca City, Okla. The only extra equipment required by the contractor was a set of batcher-plant scales for a bin and a calibrated water tank. This tank was built under the supervision of the company engineer. The tank was used on the 21-E paver, with which all the slab was placed. Another tank very similar in design was built for the small stationary mixer used for curb and gutter work. As the base and top mixtures required different amounts of water, the tank had to be supplied with two overflow pipes. By setting either overflow pipe at the calibrated elevation on the tank, any desired amount of mixing water could be obtained. This method of apportioning water proved very satisfactory on both the large and small mixer.

In the matter of equipment the engineering department was not as fortunate as the contractor. After a study of the testing equipment employed in the laboratory, the following equipment was purchased: (1) Set Buffalo Scales, 250-lb. capacity, upper beam graduated to hundredths of pounds, lower beam graduated to pounds. These scales were of the platform style. (2) Screen shaker, constructed at a local carpentry shop. It may be stated, however, that most of the tests were conducted in the state laboratory. This was necessitated by the late arrival of some of the city equipment.



This plan although diagrametic will give some idea of the water tank arrangement. The tank was fastened with tie rods to the channels on top the mixer

Water Tank Arrangement on 21-E Paver

Standard Tyler sieves number 4-8-14-28-48 and 100 were assembled for the sieve analysis of fine aggregate. Several paint cans of 2 to 5 gal. capacity were cleaned and calibrated. These cans were used in making unit weight determinations. With the addition of several flat cake pans and two refrigerator pans the laboratory equipment was complete.

The field equipment consisted of the following: Four standard 6x12-in. steel cylinder moulds. Each cylinder was provided with a ⅜-in. faced steel plate for cap and bottom of cylinder. The tamping rod was a ¾-in. steel rod, 18 in. long with one end rounded to form a bullet nose. A trowel with a square end, a spatula with a 1½-in. blade were also included.

Preliminaries in Designing the Mix.—In collecting preliminary information for the design of a mix, care was taken to employ methods endorsed by the American Society for Testing Materials. In a sieve analysis of the coarse aggregate, a sample of 75 to 125 lb. was taken from the loading bin. This sample was weighed wet, dried and reweighed to obtain the per cent of moisture. After drying, the sample was passed through sieves ranging from 2½-in. to the No. 8. Dust passing the No. 8 was recorded as "Pan." The total weight retained on each sieve was recorded and the "fineness modulues" calculated. The fine aggregate was handled in the same manner.

As 6x12-moulds were used, all unusually large rock fragments were thrown out in casting a cylinder. Each was filled in three layers and each layer was rodded. The side of the specimen was then spaded with a spatula to insure a smooth surface free from honeycomb and the top was struck flush with the mould and the specimen allowed to set for three hours. As soon as the cylinder was cast a batch of paste for capping was made up and also allowed to set for three hours. At the end of this period the paste was retempered and placed in a mound or cone shape in the center of the cylinder. The steel cap was then forced down on the paste until contact was made with the rim of the mould. After 24 hours the form was removed and the cylinders were stored in moist damp sand until a short time before testing. The bulk of the slab work was located in two districts, one in the northwest part of the city, the other in the extreme south portion.

Central Proportioning Plants.—This necessitated the construction of two central proportioning plants. The plant was laid out in two complete units, one for the handling of curb and gutter work, the other for slab. The curb and gutter unit consisted of a steel bin divided for the separation of rock and sand. Below the bin, and supported by the bin legs, was a platform on which a small 1-sack mixer was mounted. Above the mixer was a hopper in which the material discharged from the large bin was weighed. The cement platform was at one side, but integral with the mixing platform. Concrete was discharged from the mixer directly into the tracks.

A wood bin of about the same capacity and design as the steel bin was used for the slab unit. This was erected some 50 ft. north of the curb and gutter plant and was served by the same road. Below this bin and suspended on the lever arms of the batcherplant scales were two hoppers for weighing the coarse and fine aggregate.

The coarse aggregate pile was a source of considerable trouble at the beginning of the season. Shortly after unloading the sixth car of rock, the large traction gear on the crane was broken, necessitating the piling of ten or twelve cars of rock from one location. This resulted in a cone shaped pile with a great deal of coarse rock at the bottom and mostly fine at the top. In loading the bins the crane operator had great difficulty in keeping a uniformly graded rock. This in turn affected the designed mixes and on first assumptions was thought to have caused a great part of the trouble in maintaining a workable mix with a constant quantity of water.

Designing the Mix.—The first mix was designed for a "fineness modulus" of 7.50 for rock and 2.33 for sand. Excellent results were obtained with this mix when the rock gradations were uniform. Occasionally poor graded rock and variations in moisture in the sand would cause the mix to be either barely workable or too wet. It was soon determined however that the moisture content of the sand had a far greater effect on the mix than the rock gradation. The wide variation of the moisture in the sand in consecutive batches was due mainly to an inadequate stock pile to which sand of different degrees of wetness was added daily, the loads at times varying as much as three per cent in moisture content.

The mix was based upon dry, rodded volumes, the average being 1:2.31:3.50 for a 3,000-lb. concrete having a 2-in. slump. These volumes were changed to weights, making the proportions 94 lb.; 260 lb.; 360 lb., to which the weight of the moisture in the sand was added.

The fineness modulus of the sand ranged from 2.30 to 2.66. A fineness modulus of 2.33 on sand was maintained in the batches using rock of 1½ to 2 in. maximum size. The fineness modulus of the rock ranged from 6.44 to 8.07, a considerable variation. As stated previously, however, the variation in rock fineness modulus did not have as much effect upon the resulting mixes as did the moisture content of the sand.

Conclusions.—As a result of the trial related our conclusions are as follows:

1. As the work progressed, both the contractors' and engineers' organizations became more experienced in the use of water-cement ratio and were more able to keep the mixtures under control; hence a more uniform concrete was obtained as shown by test records.

2. No appreciable saving in cost was made on this season's work due to the fact that the saving in cement was offset by increased engineering cost. This increased cost of engineering will be reduced in the future due to the experience gained during the past season.

3. The use of water-cement ratio will automatically increase efficiency about the plant, and will call attention to conditions which are ordinarily overlooked, such as inadequate and poorly graded stock piles, and mechanical features of plant equipment which may be obsolete or in bad repair.

4. When contemplating the use of water-cement ratio it is suggested that the minimum allowable strength be determined with a margin of safety in case there are no facilities for making cylinder tests as a check on the determinations.

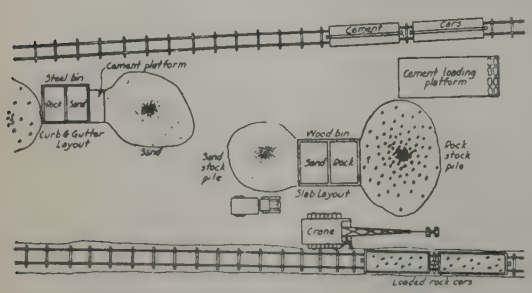
5. It is our intention to continue the use of water-cement ratio in the future so long as the successful bidder on the season's work is willing to cooperate and produce the desired results. However, contracts for the work will in all probability be drawn up with water-cement ratio as an alternate, until such a time that its use is more universally adopted by engineers and contractors in this line of work.

TEST CYLINDER RECORD

CURB AND GUTTER CYLINDERS

No.	Date Made	Date Tested	7 Day Strength	28 Day Prediction	28 Day Strength	Mix	Designed for
1	6-27-27	7-4-27	1260 lb.	2325 lb.	3060 lb.	1:2:4	
2	6-27-27	7-5-27	1750 lb.	3007 lb.	3100 lb.	1:2.4:3.3	3000 lb.
3	6-28-27	7-6-27	1828 lb.	3110 lb.		"	"
4	6-28-27	7-28-27			1900 lb.	"	"
5	6-30-27	7-7-27	1583 lb.	2778 lb.		"	"
6	6-30-27	7-28-27			2260 lb.	"	"
7	7-1-27	7-8-27	2118 lb.	3498 lb.		"	"
8	7-1-27	7-29-27			3200 lb.	"	"
9	7-2-27	7-9-27	1470 lb.	2620 lb.			
10	7-2-27	7-30-27			2950 lb.	"	"
17	7-9-27	7-16-27	2425 lb.	3905 lb.		"	"
18	7-9-27	8-2-27			3700 lb.	"	"
			SLAB CYLINDERS				
101	7-12-27	7-19-27	2335 lb.	3777 lb.		1:2.31:3.50	"
100	7-12-27	8-9-27			3620 lb.	"	"
104	7-19-27	7-26-27	2220 lb.	3620 lb.		"	3250 lb.
105	7-19-27	8-16-27			3520 lb.	"	"
106	7-22-27	7-29-27	3580 lb.	5375 lb.		1:2:3.5	"
107	7-22-27	8-19-27	1926 Mix		4750 lb.	"	
110	7-25-27	8-1-27	4060 lb.	2995 lb.		1:2.15:3.5	3500 lb.
111	7-25-27	8-22-27			4830 lb.	"	"
116	8-1-27	8-8-27	2750 lb.	4322 lb.	3750 lb.		
117	8-5-27	9-2-27			3100 lb.	1:2.11:3.73	3375 lb.
119	8-6-27	9-3-27			3950 lb.	"	"
120	8-6-27	8-13-27	1990 lb.	3330 lb.		"	"
131	8-8-27	9-10-27			3400 lb.	1:2.30:3.41	"
132	8-18-27	8-25-27	2370 lb.	3830 lb.		"	"
137	8-22-27	9-13-27			3510 lb.	"	"
138	8-22-27	8-29-27	2230 lb.	3640 lb.		"	"
145	9-13-27	9-20-27	2810 lb.				
146	9-13-27	10-4-27			3350 lb.	1:2.13:3.60	"

Test Cylinder Record Sheet. Comparison Can Be Made Between the Designed Strength and the Strength Actually Secured



Lapout of Double Central Proportioning Plant

Increase in Property Valuations Due to Paving

The Toledo City Journal cites the following case showing the increased valuation of abutting property due to paving:

At the request of the president of Queens Borough, New York, a city engineer made a careful study of the valuation of all property lying along two streets before and after paving. In the case of Liberty Ave., the paving cost $152,552. Within four years the value of the property increased by $1,400,000, or nearly 10 times the cost of paving. The Ditmars Ave. paving cost $41,007. Within four years property abutting this pavement increased in value over $8,000,000. The estimated normal increase was $1,500,000, so a net increase of $6,600,000 was attributed directly to the new pavement.

Swimming Pool Dimensions for Officially Recognized Competion

Proportions for Pools Based on Regulations of A. A. U.

THE following data, compiled by the Portland Cement Association from the rules of the Amateur Athletic Union of America, gives the regulations which must be observed in the construction of a swimming pool in which can be held championship events.

The rules for swimming are analogous to those of baseball, tennis, billiards, bowling, etc., in that the dimensions of the field of play are fixed.

The restrictions laid down for swimming are not published in any summarized form, but occur here and there in the "Official Athletic Rules and Handbook" of the Amateur Athletic Union of America—commonly called the "A. A. U."

The rules of the A. A. U. which apply are quoted below.* It will be observed that no definite pool sizes are given. Following the A. A. U. rules will be found some comments on pool sizes which are commonly used.

Swinning, Diving and Water Polo Rules.—All national championships and all open amateur swimming and diving competitions held in the United States are conducted under the following rules. These rules are practically the same as the international rules under which Olympic Games competitions are conducted.

The Bath.—The end walls of the bath shall be parallel and vertical, and so constructed that the competitors can push off in turning with the hands or feet. The walls shall extend at least 3 ft. below the surface of the water.

The starting platform shall not exceed 2 ft. 6 in. in height from the level of the water for indoor competition; in open water it shall not exceed 5 ft., but in either case the height must not be less than 18 in. The surface of the starting platform should be covered with cocoanut matting or some similar material.

The Course.—For competition in open water, the course shall be marked off distinctly and visibly. The starting and finishing lines shall be at right angles to the course, and must be firm. There shall be turning boards at both ends of the course, which shall be as wide as the course, extending not less than 3 ft. under water and 12 in. above surface. If the finish is not at the end of the course, it must be at a firmly fastened pole or rope suspended not less than 2 ft. above the surface of the water, and decorated with streamers or flags so as to be visible to the contestants. In a long distance straightaway swim the finishing line must be not more than 100 ft. in width.

The Race.—For all free style and backstroke events each competitor shall have at least 5 ft. of clear space unobstructed by steps, ladders, fountains or overhanging pieces which will interfere with swimming or turning. For breaststroke events each swimmer shall have a 7-ft. lane. The referee shall see that this rule is strictly enforced.

Plunge for Distance.—The maximum height of take-off for the plunge for distance shall be limited to 18 in. above the surface of the water.

A line may be made or painted along the bottom of the pool or tank to enable the competitors to guide themselves.

Championship Events.—Indoor championships shall be held in enclosed baths not less than 20 yds. in length.

Outdoor championships shall be held in water not lower than 62 degrees in temperature, and indoor championships in water 70 to 78 degrees.

Records

In swimming competitions Amateur Athletic Union records shall be recognized over the following distances:

Free Style.—50, 100, 150, 220, 300, 440, 500, 880, 1,000 yards and one mile.

Backstroke.—100 and 150 yards.

Breaststroke.—100 and 220 yards.

Relay Racing.—Club teams of four and five men, each to swim equal distances of 50 and 100 yards.

Plunging.—The time consumed in plunging distances of 60 and 75 ft., and the greatest distance covered in one minute.

There shall be three records for each distance in yards, recognized as American Amateur records. They shall be (1) 20-yard pool records, (2) short-course records (made over courses 25 yards up to 50 meters, approximately 55 yards), and (3) long-course records (made over courses 50 meters and up).

For 100, 200, 300, 400, 500, 1,000 and 1,500 meters free style, 100, 200, 400 meters backstroke, and 100, 200, 400 and 500 meters breaststroke, only short and long-course records will be recognized.

Only long course records shall be accepted as records for distances exceeding 500 meters. Twenty yards bath records shall include all records made over any course less than 25 yards, but at least 20 yards in length.

American Amateur records can only be made in still water, or in tidal water where the swimmer has not been aided by the tide.

The course must be measured at the time (of record trial) and certified correct by a surveyor or a duly qualified official or approved by the swimming committee.

Amateur Athletic Union Regulations for Diving

Based on International Amateur Swimming Federation Rules, with slight changes to meet conditions in United States.

General Rules for All Diving Contests.—Dives are either springboard dives, or dives from high, rigid platforms.

Special Rules—Springboard Diving

The Springboard.—The diving boards used for the contests in springboard diving shall be 3½ ft. and 10 ft. above the water level; they must be slightly elastic and at least 13 ft. long and 20 in. wide, covered with cocoanut matting, and fixed in such a way that the front of each board projects at least 3½ ft. beyond the edge of the bath.

Depth of Water.—The depth of the water underneath a 10-ft. board shall be at least 12 ft. and underneath a 3½-ft. board at least 8 ft. (This depth is urged to encourage the construction of pools of greater depth.)

High Board Rules

Diving Platforms.—Diving competitions should be performed:

From rigid platforms not less than 15 ft. long, 6 ft. wide, covered with cocoanut matting, and fixed free from spring, the back and sides surrounded by a handrail, the front of each platform projecting at least 3½ ft. from the edge of the platform immediately underneath, at standard heights of 12 to 18 ft., 18½ ft. to 24 ft., and over 24 ft. above the surface of the water. Maximum height 36 ft. For women's competitions the maximum height shall be 24 ft.

Depth of Water.—The depth of water at the point of entry shall be not less than half the height of the platform from which the dives are to be made, with a minimum of 12 ft. From heights of 32 ft. and over, a greater depth of water than 16 ft. is not required.

Water Polo

Field of Play.—The distance between the goals shall not exceed 30 yards or be less than 19 yards; the width shall not be more than 20 yards and shall be of even width throughout the field of play. The two-yard and four-yard penalty lines and the half distance shall be clearly marked on both sides of the field of play.

Depth.—The water shall not be shallower than 3 ft.

Goals.—Goal posts shall be fixed at each end of the field of play. These

*From Spalding's Athletic Library.

must be at least 1 ft. from the end of the bath or from any obstruction. The width between the posts to be 10 ft., and the cross-bar to be 3 ft. above the surface when the water is 5 ft. or over in depth; when the water is less than 5 ft. in depth, the cross-bar to be 8 ft. from the bottom. Nets must be attached to the goal posts in such a way as to close the whole goal area, and hang below the surface of the water. The back of the net must be at least 1 ft. behind the goal line and hung from the height of the cross-bar. Goal posts and nets must be provided by the home team.

General Considerations

It is easily seen that the A. A. U. rules quoted above are not general in scope as to pool sizes, but are specific where limiting dimensions are necessary for the sport.

A pool should conform to the limitations quoted above if major swimming events are to be sought as attractions, and if such a pool is to be built, the rules quoted become design data.

The sizes of indoor pools vary considerably, but the following range is fairly inclusive:

20x60 ft.	20x75 ft.
25x60 ft.	25x75 ft.
30x60 ft.	30x75 ft.

It will be observed that the lengths are all an exact number of yards. Nearly all the events are a certain number of yards, and that accounts for the length-in-yard preference. Also, five lengths of a 60-ft. tank equals 100 yards, and four lengths of a 75-ft. tank equals 100 yards. The widths are multiples of 5 ft. because 5-ft. swimming lanes are used for the majority of events.

Pennsylvanians Prefer 1-Family House.—Of 19,237 families in Pennsylvania provided with new homes in 1927, 14,406 were housed in 1-family structures. Seventy-five per cent of those who built or bought new houses during the year preferred 1-family dwellings. These facts were brought out in a report made by William J. McGuire, Director of the State Bureau of Statistics, and show that $184,162,848 was spent for new construction during 1927, of which $97,443,991, or 52.9 per cent, went into the building of 1 and 2-family dwellings, apartments and hotels and lodging houses. But of all the expenditures in this class for 1927, 71 per cent went for the construction of 1-family dwellings, 6 per cent for 2-family homes, 19 per cent for apartment houses and 4 per cent for hotels and lodging houses.

Street Sanitation Officials to Meet in October.—The 9th annual conference of the International Association of Street Sanitation Officials will be held in Toronto, Canada, King Edward Hotel, Monday and Tuesday, Oct. 8th and 9th, 1928. A. M. Anderson, 10 South LaSalle St., Chicago, Ill., is secretary.

Many Uses of Portable Deep Drill Rig by Engineering Department of Los Angeles

An all-steel portable drill rig is used by the Survey Division of the Engineering Department of the city of Los Angeles, Calif., in making deep test holes. This equipment drills a 6 to 12 in. hole to a maximum depth of 600 ft., using casing, where sufficient clay or hard rock is not present to insure firm walls. This casing is all salvaged as soon as tests are completed and is used again and again, except in the case of permanent wells, which are desired for tests of ground waters. Holes are drilled to rock or equivalent formation to meet requirements and through it, when necessary to determine the substrata.

The many uses to which this drill rig were put during the past year were outlined as follows by A. D. Campbell, Engineer Sewage and Field Work, in the report of the Engineering Department for the fiscal year ended June 30, 1927:

Forty tests have been made for the bridge department to determine the formations on which abutments and piers must stand.

Thirty-three tests for the sewer department to ascertain earth formation to be expected in excavating for tunnel work, which findings enabled contractors to give more intelligent bids.

Fourteen holes were sunk for the legal department in determining land values based on depth of commercial deposits of sand and gravel.

Eighteen special tests were made covering general conditions, water level and formation.

A total of 105 holes, averaging 32 ft. in depth were logged.

Tests have been successfully made of formations underlying 80 ft. of quicksand in the Los Angeles river at Newell St. Footing tests were made for the Glendale Hyperion Viaduct under quicksand and bog conditions.

From the data shown by these test holes it was decided to use concrete piling under certain of the abutments and piers, and to omit piling in other cases. Because of these tests the designers were able to anticipate with reasonable assurance the foundation conditions which would be encountered.

Exact information pertaining to the subsoil conditions under water has been made possible by the use of this equipment, through gravel and rock to depths not practical with hand tools.

Work has been done in 26 sections of Los Angeles without tearing up the pavements or blocking traffic with great mounds of dirt.

Geological conditions, locally, are very broken and irregular, especially in relation to surface work, resulting in marked changes in formation in but a few feet of distance. An example of this is furnished by the several changes in the channel of the Los Angeles river during the history of the city. The old channels have been covered with clay deposits and fills of every conceivable kind, making it necessary that actual existing conditions be ascertained for the design of new work in these sections.

Things not on the records are sometimes discovered, as was an uncharted telephone cable at 4th and Hill Sts., which had been laid around rather than through the manhole. The drill found it and put it on the map, along with impaired phone service on over 3,600 pair of lines.

In testing for footings for the new First St. Viaduct over the Los Angeles river, no water was encountered until 30 ft. below the level of the water in the river channel, although only 25 ft. from its edge. At Pacoima Ave. in the San Fernando Valley, a clay deposit was found in the center of the river, while on either side were deep deposits of sand and gravel.

In the Newell St. tests, before mentioned, on the west side of the river, nothing but quicksand was encountered to a depth of 100 ft., while in a hole 125 ft. east, at the center of the present channel, clay was the predominating formation. On Greensward Ave. near Glendale, surface water at 4 ft. was the rule of that section, yet a test hole 22 ft. deep, located 59 ft. from a well, developed no water.

The plane of any given formation is easily traced by drilling three or more holes, as was done in gathering data for the proposed Victory Park condemnation. These data disproved valuation estimates for damages claimed and will effect a saving to the city of many thousands of dollars, if this project is completed.

During the construction of a curved tunnel on Section 36 of the north outfall sewer, a shaft was desired near the center of the work through which to drop a plumb line from the surface to check the accuracy of the alignments. The well rig was called to do this work and in a few hours had a 35-ft. hole through to the tunnel at the desired point.

In the Venice canal zone, no record of previous subsoil exploration had been kept. The drilling rig furnished the first authentic record of underground conditions for building foundations, drainage, and method of controlling ground water.

The uses of this equipment are varied, but all subsoil conditions for any purpose, can be quickly determined by this method. To date this rig has filled every order and completed every hole started under any condition, furnishing the information desired in full.

Filtering Materials for Sewage Work

Notes on Kind, Size and Depth

By N. T. VEACH, JR.
Consulting Engineer, Kansas City, Mo.

THE importance of proper selection of filtering materials for use in sewage work is apparent from the fact that there are, at least, 700 sewage disposal plants in this country using some kind of filtering material, exclusive of that used in sludge-beds. These plants are serving an approximate population of something like 5,500,000 people. The constantly-increasing urban population, and the somewhat slow but steadily-growing sanitary conscience on the part of the public, generally, that it is proper and necessary to dispose of its sewage and other wastes in an adequate manner, means that the selection of proper material to use in the construction of sewage-disposal plants will, in the future, constitute a very important phase in sewage disposal.

Kinds and Quantities of Filtering Materials.—Filtering material for sewage work can be divided into two general classifications, namely, coarse-grained and fine-grained materials. Coarse-grained materials are used in trickling filters or contact beds. The following materials have been used for this purpose: (1) Limestone; (2) trap rock; (3) quartzite; (4) granite; (5) broken slag; (6) broken smelter retorts; (7) wooden slats; (8) brush; (9) gravel; (10) dolomite; (11) coke breeze; (12) flint; (13) cinders; (14) coke; (15) sandstone. Of the above materials, limestone has been used most extensively. Studies made by the Committee on Filtering Materials, of the Sanitary Division of the American Society of Civil Engineers, indicate the following quantities of different coarse-grained materials in use in the United States:

	Cu. Yd.
Limestone	583,300
Trap rock	301,500
Granite	216,300
Quartzite	15,300
Gravel	28,100
Flint	1,200
Crushed stone (kind not given)	10,500
Slag	15,140
Cinders	3,100
Coke	5,200
Blue rock	2,400
Coke breeze	3,000
Crushed retorts	2,700
Joplin chats	200
Miscellaneous	5,200
Total	1,368,900

Relative Merits of Different Materials.—The progress report of the above committee (Proceedings American Society of Civil Engineers, April, 1927) shows that 30.7 per cent of the trickling-filter plants investigated showed disintegration, and 37.4 per cent showed clogging. Some of the clogging troubles are, no doubt, due to overloading, and character of applied sewage, but a large number are due, primarily, to the disintegration of the filtering material. The committee referred to expects to carry on further investigation, including quite extensive testing, in order to get some definite data on the relative merits of the different materials. Until some definite data are available, it will be necessary for those designing plants to pick the best material available, within reasonable cost. Such materials as granite, trap rock, quartzite and gravel have proved uniformly satisfactory, although there are places where some of these have shown disintegration. A number of plants using limestone have operated over a period of several years without noticeable disintegration. An interesting fact worth mentioning is, there is one plant, using broken sandstone, that has been in operation something over twelve years, without showing any appreciable disintegration. Of course, the best materials are not always available within the limits of reasonable cost, and it is necessary to use the best material at hand. In several places, this situation has been met by placing on the top of the filter bed, from 6 in. to 1 ft. of material known to withstand disintegration. It has not been definitely determined just how far down into the bed the weathering or disintegration goes, but it appears that it does not go very far, at least, for several years of usage.

Sprinkling Filters at New Sewage Disposal Works of Decatur, Ill.

Size of Material.—In regard to the size of material for use in trickling filters and contact beds, the practice in this country has varied over a wide range. These sizes range from a grading of ¼ in. to 2½ in. to one of 2 in. to 3 in. The ideal material would be the smallest size that would operate without clogging. The smaller the size, the greater area of stone available for contact and the formation of bacterial film or jelly. Uniformity of size is also an advantage. In practice, it is difficult to obtain a satisfactory stone without screening. Ordinarily, a grading of 1½ in. to 2½ in. will give best results; but slight variations from these sizes are possible, if the screens at the quarry from which materials are obtained do not give this exact grading. A minimum size of not less than 1 in. is advisable.

Depth of Filters.—In regard to depth of filters for trickling-filter installations, the practice in this country, as in the matter of sizes of material, has varied considerably. The depths have varied from 4 ft. to 10 ft. Usually, the depth of filter is determined, largely, by the amount of head available. Where head is not a determining factor, the problem becomes an economic one, qualified by the probable bacterial efficiency, which varies, depending on the character of sewage to be treated. A greater depth will ordinarily result in lower construction costs. The limits of depth are: the ability properly to ventilate the bed, the clarity of the settled sewage to be

treated, the character and size of filtering material, and evenness of distribution. A majority of the existing plants have been built with a depth ranging from 5 to 7 ft. Where ample head is available, practice seems to have been to use a depth ranging from 6 to 9 ft.

The above discussion of kinds of filtering material for trickling filters applies, in a general way, to material for use in contact beds. There has been a greater tendency to use such materials as coke, clinkers, cinders, broken brick, broken pottery and the like in trickling filters than in contact beds. This may be due to some extent, to the fact that smaller sizes can be used in contact beds. Also, there has been a tendency to favor materials having as porous structure as possible, on the theory that the bacterial film or jelly will form quicker and adhere better to such material than to that having smoother surfaces.

The necessity of selecting material that will withstand weathering and disintegration is, perhaps, more important in connection with contact beds than in trickling filters, due to the fact that a smaller size has ordinarily been used. The possibility of clogging and poor ventilation are also greater. There is a tendency to increase the size of material for use in contact beds, as evidenced by a number of the later installations.

Depth of Contact Bed.—The depth of contact beds is influenced by the same general principles that apply to trickling filters, such as economical construction, obtaining proper ventilation, available head, etc. Best evidence indicates that the bacterial efficiency is not affected by the depth of the beds. As more surface for contact is available with smaller-sized material and proper ventilation is harder to get with smaller sizes, practice, in this country and abroad, has been to use shallow depths compared to that used in trickling filters. These depths have ranged as low as 3 ft. and even less. The majority of plants have beds ranging from 4 to 6 ft. in depth, and, unless there is some unusual condition, such as having a settled sewage to treat which would have some unusual tendency toward clogging, depths within this range should be satisfactory.

Fine-Grained Filtering Material.—Fine-grained filtering materials in sewage work consists almost entirely of sand. Sand is used in intermittent filters and in sludge beds. There are something over 300 intermittent sand sewage filters in the United States, of which, perhaps, 15 per cent are serving institutions or industrial establishments. This type of secondary treatment gives, perhaps, the best results of all types of plants. However, they require considerable attention to keep the beds in proper working condition, and require a great deal more area than the other types.

Sand is also used in most sludge beds, and it is probable that the yardage of sand used in such beds equals that in intermittent filters, as a majority of plants of all types include them.

There is not a great deal of information on the proper grading of sand for use in intermittent sewage filters, or in sludge beds. There are many instances of clogging, some due to improperly graded sand, some to overloading, and some to the applied settled sewage, especially where it contains any appreciable amounts of fatty substance, or other waste having a tendency to clog the beds.

In many places natural deposits of sand and gravel are used by grading surfaces, and arranging for intermittent dosing upon the different parts of the bed or beds. Where natural deposits of material are not available, it is necessary to build artificial beds, using sand obtained from the nearest available supply which will meet the requirements set forth in the specifications. Sand containing clay, loam or silt, or that which contains too much fine material, will not give satisfactory results. The bed not only acts as a strainer, but also acts as a breeding place for oxidizing bacteria. Ventilation is vital for successful operation. An investigation of the requirements as to grading by different state boards of health, indicated a uniformity coefficient ranging from what is termed "as low as possible" to 3.5 mm., the majority being from 2.5 to 3.5 mm. Likewise the effective size ranges between the limits of .25 mm. to .50 mm.

Depths of Intermittent Sewage Filters.—The depth of intermittent sewage filters varies from 2 ft. to 5 ft. or more. A majority of the artificial beds range from 3 to 4 ft. above the underdrains. The depth of beds must be governed by the character of sand used. A slightly greater depth is desirable with fine sand as compared to coarse sand on account of the fact that fine sand will raise the water level above the underdrains by capillary attraction. Beds having fine sand, if sufficient in depth, will give best results bacterially, but cause more trouble in operation. The use of coarser sand, and operating at lower rates, will give satisfactory results, and less operating troubles.

The Committee on Filtering Materials of the American Society of Civil Engineers is carrying on an investigation of fine-grained materials at the present time, and it is hoped the results of its studies will give some additional information in regard to grading, etc.

Acknowledgment.—The above is a paper presented at the 10th Texas Water Works Short School.

How One City Started Its Original Community Safety Work

Opening the summer period of increased traffic hazards, the city of Asbury Park, N. J., planned a special "Safety Week" during May 14-21 for the widespread education of the citizens in accident prevention. The campaign was sponsored by the American Legion and the active work was carried on by a central committee made up of special committees from civic organizations, the chamber of commerce, the public safety commissioner, the mayors of the different boroughs, and representatives from the public utility companies.

According to "Public Safety" a high degree of cooperation was secured from all these organizations, the schools and private citizens, and the public safety commissioner has announced that the campaign resulted in a lower public accident record than the city has enjoyed during any week in three years.

Hundreds of posters were distributed by boy scouts, and large public safety posters were put up near the schools and at prominent street intersections. The trolley cars also carried big posters, and near the railway stations a huge bulletin board was set up, illuminated by a spotlight, on which statistics about accidents and special messages concerning safety were displayed from day to day.

A trolley car of the Coast Cities Railway was painted white, lettered prominently with safety slogans and was run continuously throughout the city. Daily the newspapers kept the idea before the people with instructive articles. The moving picture theaters cooperated with a safety picture; and public addresses were delivered at the civic organizations and the schools.

Boy scouts took an active part in the campaign, giving the life saving demonstrations in the natatorium, distributing literature, and on the final two days of the week they handed out 10,000 cards to jaywalkers. About 20,000 stickers bearing the message "Drive Carefully—I Do!" were placed on the windshields of cars parked in the city streets.

The schools played an important part in the week's activities. The teachers were given safety manuals from which they selected features on safety work which were handled along with the regular curriculum. About 150 safety posters were drawn by the children, and prizes were awarded to the 12 best posters.

Another activity of importance was a special inspection carried on during the week by the fire department of many buildings where fire hazards were suspected. Following the close of the campaign, a committee was appointed to carry on public safety work throughout the year.

Experiences With Crenothrix in Ground Water Supplies

Methods of Combatting Growth by Application of Chemicals

By K. W. BROWN
California Water Service Co., Stockton, Calif.

PREVIOUSLY published descriptions of the control and destruction of Crenothrix infections have dealt with water supply systems operating central pumping stations and purification plants. Under such circumstances it is possible to initiate means of treatment which, generally speaking, enjoy possibility of success. In California systems, however, with which the writer has had experience, the distribution mains are often supplied from wells in scattered locations. The problem of treatment is further intensified in that the automatic deep well pumps discharge directly into the distribution system.

Iron removal, in itself not always easy nor entirely satisfactory, is out of the question on account of the scattered arrangement of pumping plants. Systematic flushing, requiring a rather considerable labor expenditure, affords benefits that are merely transitory, and is of little effect insofar as improving general community opinion of the water's wholesomeness is concerned. Under such circumstances it becomes necesary to combat Crenothrix growths by methods that are, at least, comparatively inexpensive. All of which necessitates control or elimination by application of chemicals.

Experiences at Redondo.—At our Redondo plant we have a Crenothrix infested well discharging through a sand box to a storage reservoir. Until about a year ago somewhat inadequate control of the situation had been realized by means of treatment with copper sulfate and chloride of lime. The chemical solutions were prepared in oak barrels and fed directly to water passing through the sand box. This cumbersome and inaccurate system was replaced by a direct feed chlorinator. Following inauguration of chlorination at a rate of .60 p.p.m., we received an unusual number of complaints, but these lasted only four or five days, after which adverse comment was more or less of a rarity. Reduction of the dosage to .40 p.p.m. so as to avoid possible waste of chlorine, resulted in equally pleasant conditions. Attempts to further decrease the rate of feed were less successful as indicated by an apparent tendency toward poorer quality of water with respect to taste and odor. This spring, however, we experienced a revival of obnoxious water, particularly in one section of town located at a somewhat higher elevation than the average. As a result, it was decided to try sterilization of the offending well by pouring into it about 100 lb. of copper sulfate in solution. Introduction as a solution checks the possible action of crystalline copper sulfate on the well casing. After 24 hours the well was pumped to waste until clear water was obtained which, in this case, required a period of about 40 minutes. It should be noted that the efficacy of well sterilization in this manner is largely a matter of chance. The age and extent of Crenothrix infection, and location with respect to direction of ground water flow influence susceptibility to treatment. That such radical procedure is worthy of trial has been demonstrated at Redondo. Tufts of iron colored, Crenothrix bearing material discharging from the well have been eliminated and complaints have practically ceased.

Experiences at Bakersfield.—At Bakersfield we encounter, in some sections of the system, an annual epidemic of black water. The fact that those occur each spring leads one to the belief that they are indicative of seasonal changes in pipe growths of filamentous organisms common to ground waters. The recent disturbance at Redondo, also happening in the spring, is further evidence in favor of this theory. Disintegration of the plant at this time of the year is doubtless responsible for the unwholesome and discolored water. Remedy at Bakersfield has always been obtained by intensive flushing of the affected area for about two or three days. The community, at times other than this, is entirely unconcerned with the quality of water.

A Peculiar Well at Port Costa.—We have, in the Port Costa system, a rather peculiar well that has been the source of considerable difficulty. This well, which is drilled in more or less swampy formation, is about 480 ft. deep and has a capacity of 230 gal. per minute. Water pumped from it through a weir box to a storage reservoir carries large tufts of filamentous growths. This material is expelled in sufficient quantity to necessitate installation of a screen box for its removal. Two screens, 4x4 ft., of ¼ in. and No. 14 mesh respectively, are effective in removing practically all of the offensive appearing flakes. The system of screens is provided in duplicate so as to permit washing without interrupting operation. After passage through the screens the water is treated with both copper sulfate and chlorine, applied in the weir box at rates of .50 p.p.m. and .25 p.p.m. respectively. Although material washed from the screens produces foul and offensive odors as a result of decomposition, complaints regarding taste and odor have been entirely absent.

Experiences at Stockton.—The most obdurate and treatment defying ground water supply we have is that at Stockton. At the principal pumping plant, nine deep well pumps discharge through four inlets to a 2,000,000 gal. reservoir, from which water is pumped to distribution. Three other stations have a total of five automatically operated deep well pumps discharging directly into the system.

Microscopic examination of pipe samples collected from numerous locations indicated Crenothrix infection to be universally prevalent throughout the system. Leptothrix, a somewhat similar organism, was also observed in some abundance.

About eight years ago, following replacement of existing suction lift pumps with deep well equipment, the reservoir became infested with heavy filamentous growths and, at the same time, taste and odor became unduly apparent.

To combat these conditions, application of copper sulfate, followed by intensive flushing, was begun. This practice is still in effect, although flushing is confined to that necessary to relieve complaints, which are quite frequent in the vicinity of dead ends. The chemical is fed in solution to the main suction line at Station 1 at an approximate rate of one part in twenty million. Obviously, this is a minute dosage and is of doubtful value, if any. Reservoir growths have been successfully inhibited by spraying the walls twice weekly with a solution of bluestone. This solution, consisting of 6 lb. of copper sulfate in 15 gal. of water, is sprayed from equipment transported by boat. Water in the reservoir is lowered each time in order to expose the walls sufficiently.

Sterilization of two or three wells with bluestone in the previously described manner has been attempted, but no particularly beneficial effect has been observed. In this instance it is probable that subterranean conditions are not susceptible to such treatment.

Cleaning Water Mains by Chemical Means.—In order to investigate the feasibility of cleaning water mains by chemical means, we removed two sections of 4 in. pipe from service and subjected them to treatment. A solution containing .30 p.p.m. of available chlorine was passed through one section for a period of five days at a rate of 150 gal. per 24 hours. Examination of the pipe at the end of this time revealed no appreciable diminishing of the original ½ in. interior lining. This is contrary to results of experiments conducted by Stevens at Marysville who reports successful cleaning of Crenothrix lined pipes with solutions containing .20 p.p.m. of free chlorine. The second section of pipe was treated at the same rate, 150 gal. per day, with water containing .50 p.p.m. of copper sulfate. At the end of five days it was found that the majority of adhering material had been successfully removed, demonstrating thereby that chemical removal of conduit growths is not without possibility. The somewhat unsatisfactory nature of these results, as evidenced by the time and dosage required, has led to the abandoning of plans for cleaning the distribution lines by such means. It had been planned to isolate sections of pipe, dose them with chemical, and flush thoroughly at a high rate of flow before replacing them in service.

Experiences With a Swimming Pool.—A somewhat unusual opportunity to study the Stockton problem presented itself several months ago. A local swimming pool using city water had, for over a year, been experiencing badly discolored water. This was caused by the precipitation, some 20 or 30 hours after filling, of an iron colored amorphous substance which completely covered the bottom of the pool. Naturally, disturbance of this material produced an appearance which was, to say the least, uninviting. Believing this condition to originate within their own system, the management indulged in a thorough house cleaning and attempted various other methods of improving the situation, but to no avail. Finally, their woes were voiced to the water company. Microscopic examination of the precipitated material immediately showed the presence of filamentous algae, thus demonstrating conclusively the source of trouble. Large mains in the neighborhood were flushed as a primary remedial measure, but this failed to even slightly obviate the difficulty. The next step was to place a weighed amount of bluestone in a burlap sack and suspend it in the pool influent at the time of filling. This dosage, which amounted to 1.5 p.p.m., proved entirely effective in preventing deposition of the Crenothrix bearing material. Sometime later the management essayed economy by cutting the amount of chemical in half which, as was to be expected, brought about reappearance of the discolored water. Return to the original prescription again produced water of satisfactory appearance. Similar excellent results were obtained by means of an experimental chlorinator installation employing a dosage of 1.0 p.p.m.

Treatment with Chlorine.—Installation of chlorine equipment on the main suction line at Station 1, using an initial dosage of .25 p.p.m., was the signal for an immediate barrage of complaints. Consumers located on dead ends were particularly disturbed, and not without justification. Reduction of the dosage to .20 p.p.m. resulted no more favorably. It was then decided to operate the chlorinator during the day only, shutting down at night as soon as the low flow period occurred. This practice, which has now been in effect for some time, has been attended by little, if any, unfavorable comment. After continuing in this manner for several months it is intended to again chlorinate during the full 24-hour period. Naturally, it is too early to venture an opinion as to the probable outcome of treatment, although it is reasonable to expect some degree of improvement. Chlorination at the remaining stations, which are automatically operated, is not contemplated until sufficient data has been gathered at Station 1. Inasmuch as about 70 per cent of the total pumpage is from this plant, it is believed that the results obtained will be quite indicative of what could eventually be realized by treatment of the entire system.

In summarizing our experiences, it appears that Crenothrix infections in ground water supplies can be eliminated by application of either copper sulfate or chlorine in those systems operating pumping plants augmented by reservoirs of adequate capacity. It is advisable, however, in order to avoid occurrence of obnoxious conditions, that introduction of the chemical be made prior to the reservoir. For systems operating a series of scattered wells there is apparently little opportunity of destroying filamentous organisms; resorting to chemical treatment will occasion inevitably distressing features, the extent of which cannot be foretold. Combatting algae by chemical application to water pumped directly to distribution from a system of scattered wells is, therefore, nothing less than a gamble, with odds somewhat in favor of the Crenothrix survival.

Acknowledgment.—The above is an abstract of a paper presented at the 1928 convention of the American Water Works Association.

One Hundred and Four Illinois Cities Have Parks.—According to a survey by the Illinois Municipal League, 104 Illinois cities and villages now own municipal parks, ranging in area from Chicago's 4,487 acres to Steelville's half acre.

Los Angeles Plans for Industrial Growth

The Manufacturing and Industries Committee of the Los Angeles Chamber of Commerce has received a report of the Trackage Conference on the conservation of potential industrial lands, which is part of a movement to protect these areas in and about the city for future development.

This conference was formed about a year ago under the auspices of the Los Angeles Regional Planning Commission, with William J. Fox, chief engineer of the commission, as its chairman. It is participated in by representatives of the railroads, a City Planning Commission, Chambers of Commerce in the district, prominent industrial real estate operators and others. The object is to coordinate railway and highway future developments whereby a minimum number of grade crossings of highways will be made by railway industrial tracks and a sufficient width of interventing land area may be protected to accommodate industries with railroad spur tracks on the one side and highways on the other.

"Tentative plans for trackage layouts for five potential industrial areas have been submitted, showing the possibilities of connecting them with essential transportation services in various surrounding districts, Long Beach, Torrance, Compton, Watts and Culver City," says the Los Angeles Chamber of Commerce in explaining the program. "These rather ideal set-ups are dependent upon the execution by interested property owners of a mutual contract binding themselves to dedicate railroad rights of way for necessary tracks. It is provided, however, that, if no industrial development occurs and no complete system of tracks is laid within a certain period, the contract may be terminated, releasing all parties and lands.

"It is generally recognized that the widespread subdivision and residential development of property in the Los Angeles district has in many cases caused undue encroachment upon lands adapted for industrial development, and that highways in many cases have paralleled railways, choking out logical industrial use of much land which, if so developed, would give greater value even to adjacent residential areas."

Towns Need Competent Engineering Service.—In an address at the 4th annual convention of the League of South Dakota Municipalities, John E. Hipple, mayor of Pierre, S. D., pointed out the importance of having efficeint engineering service for municipalities. Mr. Hipple pointed out that many towns are unable to pay the salary of an engineer, and suggested that it is feasible for several municipalities to unite in hiring the services of a competent engineer or firm of engineers for the group.

Public Sanitation Work in Liverpool, England

Practice Outlined in Paper Before British Institute of Public Cleansing

By WILLIAM MUIRHEAD
Chairman Health Committee, Liverpool, England

UNTIL recently the area of the city was divided into 23 districts, but on the extension of the city in April last, when a further area of 3,553 acres was incorporated, opportunity was taken to revise this sub-division, with the result that there are now 20 districts. The total area of the city is 24,795 acres or, when the foreshore and bed of the river are included, it becomes 27,678 acres. In all some 1,500 men are employed on the operations in connection with house-refuse collection and disposal, and street-cleaning works.

House Refuse Collection.—A weekly collection is provided and the total quantity of refuse collected (including street sweepings) amounts to approximately 1,200 tons per day. A difficulty not experienced by many municipalities is caused by reason of the lay-out of the older portions of the city, for the house refuse from nearly three-quarters of the city (with a population of 879,982) has, owing to the fact that a large number of back passages have been laid out to a width of 4 ft., to be carried by the collectors an average distance of about 45 yd. Again, in dealing with houses built adjoining our boulevard streets, the cost of collection is increased, because in most cases dual streets are provided, the two streets being in many parts separated by an enclosed tramway track.

The type of receptacle most generally in use is a fixture wall bin, which when being emptied, is temporarily removed from the wall; some 86,000 of these fixture bins are in use, the size adopted being that which has a capacity of 3½ cu. ft.

Transport of Collected Materials.—The question of the type of transport to be used for the conveyance of the collected materials is one which has for some little time been occupying the attention of my committee.

Rather more than a year ago a report was submitted by the city engineer and one by the chief veterinary officer, in which figures were given showing the relative costs of conveyance by horse and by mechanical vehicles. In view of the fact that the majority of the horse-drawn vehicles were of somewhat old types, and that some of the comparisons were made with figures obtained from the use of certain recently-purchased low-loading motor vehicles, it was decided to have a number of relatively light low-loading horse wagons constructed. In order to ascertain the relative cost of transport by these different types of vehicles, tests have been arranged which are to extend over a period of three months.

The department has now in use some 156 carts having a capacity of from 30 cwts. to 2 tons, 50 motors varying in carrying capacity from 2 tons to 6 tons, including three steam trucks and two electric vehicles.

My committee are anxious to provide as becomes practicable more of the low-loading type of vehicles, for it is found that the work of our Gratuities Sub-committee is increased by reason of the old higher vehicles.

During the past month in the city council has placed an order for a tractor and four low-loading trailers, the four latter vehicles being horse-drawn during collection, and the tractor hauling the same to the point of disposal.

Disposal of Refuse.—The systems of disposal at present in operation are four in number, namely, by (a) incineration at destructors, (b) controlled tipping, (c) barging out and dumping at sea, (d) barging along the canal (or by rail) to farmers.

Destructors.—Until some 14 months ago the corporation had in use six destructors, each working two 8 hour shifts per day. About that time two of the oldest ones were closed, and of the remainder two were placed on a single shift per day. From the steam raised at these destructors electricity is generated and sold to the Electric Supply Department. The two destructors which were closed down had been in use for more than 27 years, and considerable expenditure would have been necessary if they had been continued in operation.

Controlled Dumping. — About 14 months ago this type of disposal, which had up till then only been used to any considerable extent in ordinary dumping on sites mainly outside the city, was, on the recommendation of the city engineer, considerably extended, and for the 12 months ending March 31st last the actual cost of disposal showed a saving of over $100,000 on the estimates. This appreciable saving was affected despite the fact that some 6,600 new additional houses were served during that year, and the total quantity of material dealt with showed an apparent increase of approximately 38,000 tons. The term "apparent increase" in referring to the total quantity of material is used as much of the material is not weighed before disposal.

In this method the material is deposited in layers about 6 ft. in depth, and covered with a good layer of soil, both on the surface and on any exposed side; the working face is kept as small as practicable, such face being covered each night. The layers are kept to definite levels, and as soon as possible a covering of grass is produced on the surface.

Dumping at Sea.—The corporation owns the "S.H.B. Delta," which is specially built for the purpose of transporting refuse to sea and for the dumping of the material out at sea. The vessel has a carrying capacity of 1,000 tons, but in view of the relatively light nature of much of the domestic refuse, the average load during the year ending March 31, 1928, amounted to 742 tons.

By Canal (or Rail) to Farmers.—Two of the corporation's cleaning depots are situated on the banks of the Leeds and Liverpool Canal. The corporation owns sixteen wooden barges, and in these the materials having a higher manurial value are transported along the canal and sold to farmers for farm purposes.

In addition to the corporation's fleet, some of the material is conveyed by rail in forty-six corporation railway cars to farmers—a quantity of about 7,000 tons per annum being disposed of in this manner.

Street Cleaning and Watering.—The total length of streets cleaned within the city is approximately 615 miles, some 40 miles of which are 120 ft. or more in width. The latter roadways are usually divided by a central strip, in many cases used for an enclosed tramway track, so that for comparative purposes our mileage of streets should be increased by the addition of a length equal to that of the dual roadways.

The system adopted for the central city streets is to have the same swept by day by orderly boys each having a length of from 200 to 300 yr., these boys traverse their routes usually about six times per day. Their trolleys carry two bins, and these are emptied two or three times per day into larger street-cleaning vehicles. These streets are watered, and swept by mechanical brooms, six nights per week, one of these mechanical brooms picking up the sweepings and transporting the same to disposal points on completion of the nights' work.

In the suburban districts the work is carried out by gangs of men varying in number from three to six, which gangs are supplied with a handcart to collect the sweepings, while the larger

collecting vehicle may be absent. These suburban streets are swept according to requirements, which vary from once to six times per week.

Between these two—i. e., the inner city streets and the outer suburban streets—the system can probably best be described as a combination of the two.

In addition to the night work previously mentioned, squads of men are out washing certain streets in the central areas—this operation being more extensive in character during the winter months than during the summer months.

The total quantity of materials swept up from the streets averages about 56,000 tons per annum.

Closely allied with this work is that of the emptying of the street gullies. Until last year this was done by hand operations, but my committee has recently commenced to carry out a portion of the work by means of a vacuum gully cleanser.

Band for Large Cast Iron Pipe

The practice in New York City of using bands and bolts to hold pipe from pulling apart where bends, offsets, tees, reducers or caps are used and there are no lugs on the bell or spigot end of the pipe and fittings was described by William W. Brush, chief engineer of water supply, Department of Water Supply, Gas and Electricity, of New York City, in a paper presented at the 1928 convention of the American Water Works Association. An abstract follows.

In special cases such as the high pressure installations of recent years an amalgam of tin and lead has been successfully employed, but usually the bolts and bands are installed. For a 90 deg. bend it is customary to tie together pipe that are 12 in. and larger in diameter. On each side of a 90 deg. bend normally three lengths of 12-in. pipe are rodded while for a 20-in. and larger pipe five lengths are rodded. Where other than a 90 deg. fitting is used the number of lengths to be rodded is determined by the construction engineer based upon pressures in the pipe and character of fitting as affecting the amount of unbalanced pressure to be taken up by the rods.

Both our experience and that of others indicates that in caulked lead joint the holding power for each square inch of lead in contact with the pipe is about 200 lb. When the unbalanced pressure produces a force to support the pipe greater than this holding power, the pipe moves in the joint. Under such conditions the joint must be held together by some other means.

In November, 1927, the department was compelled to raise a 48-in. cast iron main laid in Columbia street, Queens, due to the main interfering with a new sewer. It was decided to offset the main after reducing to 36-in. diameter on account of limited cover. When the pressure of about 80 lb. per sq. in. was applied to the band on the spigot end of one 48-in. pipe moved about ¼ in. and the offset raised in the center sufficiently to allow the lower rods to drop out of place. From this experience it was evident that the bands used would not hold unless stud bolts or similar stops were placed in the pipe or unless rods were carried back of the next bell. The latter plan was considered more advantageous and was adopted as standard for future construction where lugs were not available. With all bands anchored by a hub, movement of the bands by sliding is prevented and one can rely on the rods taking up the unbalanced pressure up to the full strength of the rod.

It has also been suggested that the band might be tapped and the pipe drilled so that stud bolts would extend into the cast iron far enough to give the necessary resistance to the movement of the band by the shearing strength of the bolts plus the frictional resistance of the band. There are a number of other methods that could be followed in securing the band against movement. The interesting fact is that dependence on bands that have been clamped tightly around the pipe and by the use of bolts is not sufficient when large unbalanced pressures are to be controlled, and from our experience additional resistance to movement of the bands is essential.

Filter Flints

There is shown in the accompanying illustration the close grading of six sizes of filter flints—(there are many more sizes than these) taken from a newly uncovered deposit in Southern Jersey. In smoothness and roundness, the grains resemble marbles of different diameters. It is claimed they will withstand abrasion and wear for a very long period of time because of the fact that each grain is a piece of pure flint.

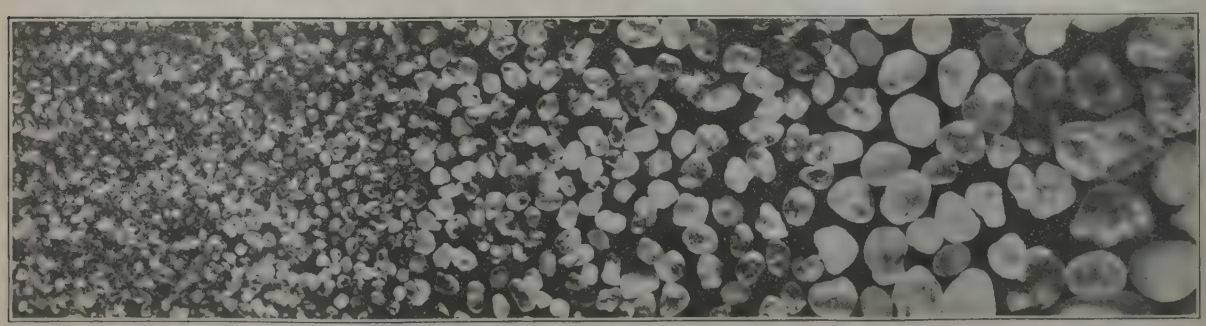
The illustration also serves to give a cross section idea of a filter bed in which these filter flints are used. Since all grains are of such uniformity in smoothness and roundness, each layer will present a series of larger openings between grains as the diameter of the grain increases. In other words, there will be uniformly large openings at the bottom layer and small at the top. The liquid being filtered will therefore percolate through the bed at an even rate of flow.

The flint hardness of the grains is claimed to guarantee practically no wear on each grain, meaning that the filtering opening between grains will remain constant and hence always give an unvarying rate of flow.

At the site of this deposit of filter flints, George F. Pettinos, 1206 Locust St., Philadelphia, has erected a plant for washing and classifying flints with great accuracy. The result is a grading for effective size and co-efficient of uniformity which, it is claimed, will meet the most exacting specifications for any class of service.

This plant itself is unique. There is nothing just like it in the country. In its method of exact sizing of many different diameters of flints at the same time, and washing each grain almost separately, this plant sets an example of efficiency which is much needed in this particular field.

While space at present will not permit a description of the plant, it is to be hoped that in an early issue we will be able to present photographs and a complete description of this new type of plant. Suffice to say that it has a capacity of 20 cars of filter flints per day, either wet or dry, washed and screened to meet any specification.



Six Gradings of Filter Flints Taken from Newly Uncovered Deposit in Southern New Jersey

Airports As a Factor in City Planning

Valuable Data on Layout Given in National Municipal Review Supplement

By E. P. GOODRICH
Consulting Engineer, New York

AIR transportation has become a recognized means of carriage of persons and property. A department of commerce report of July, 1927, records 864 operating air ports and airplane landing fields in the United States with about 3,000 additional unequipped emergency landing fields. Of the 864 fields, 207 are municipally provided, 163 are commercial or private ports, while 124 are department of commerce intermediate landing fields. Eighty-one landing fields are maintained by the Army and the Navy. The characteristics of air ports place them in the same general class with railroads and water carriers in that special terminal arrangement must be provided. Furthermore, air terminals are like railroad and water terminals from the fact that each must be located on favorable topography. Within certain limits, however, an air terminal does not need to be directly connected with the approach facilities. A railroad terminal must have main line tracks leading to it. A water terminal must have a water way to provide access. An air port makes use only of the air for accessibility and consequently is not so tied to topographic approach conditions. However, it must be so situated that the approach routes do not generally lead over cities, and for use by airplanes it should not be surrounded by high hills except at considerable distances with no high trees, chimneys, poles, or other structures in closer range. It is more than possible that the approach routes will some day be fully cleared so that air transport routes will traverse country so prepared that emergency airplane landings will be possible at any point along the route, instead of only at emergency fields located perhaps five miles apart. An air terminal must usually be placed in the open country. Like terminals of other varieties, however, they should be as close as possible to the business center of the community to be served.

Croydon is about ten miles from Trafalgar Square, London, Le Bourget is seven miles from the center of Paris, while Tempelhof is three miles from the heart of Berlin. The landing fields in New Jersey and on Long Island are so far from the hotels in Manhattan that lately it took as long to motor from one of them to New York as it had taken to fly from Boston. The Cleveland municipal field in nine and a half miles from the public square (air line distance),—about thirty minutes by auto and conceivably about twelve minutes by train. That it is undesirable to locate a field any considerable distance from the business center is indicated from the report that one European city abandoned an outlying air port and created one relatively close to the center by razing several blocks of buildings.

Ample Means of Access.—Like all other terminals, ample means of access must be provided for conveyances of other types between which and the air carrier transfer of passengers and property must be made. In the early days of the railroad and steamship, large crowds would gather for the arrival and departure of the carriers. In the early days of the automobile, auto race meets would draw large crowds of spectators for which provision had to be made. While air transportation is new, while air circuses are a novelty, and while the exceptional aeronaut is accomplishing unusual feats, extra facilities must be provided at air terminals for spectators, and highways, street railways and even steam railroad connections must be provided to transport the people. When Lindbergh landed at Le Bourget, the roads leading to it from Paris were congested with motors for miles. In other words, the highway approach accommodations were inadequate in that instance. Such thoroughfares should be provided from the field in as many directions as possible and sufficient in capacity to carry away all the automobiles of all the inhabitants of the surrounding territory for a radius of at least fifty miles within a period of perhaps three hours.

Road Space.—With one automobile for each family (there was one car for each five persons on January 1, 1928), and at a running capacity of perhaps 1,000 vehicles per lane per hour under proper policing, after assuming a factor to represent the probable percentage of vehicle owners who would wish to visit an aviation field on some special occasion, a basis is laid for a determination of the highway facilities which should be provided in a given case. (For example, assume that one quarter of Paris had desired to see Lindbergh land at Le Bourget with five persons on the average per automobile and assuming three hours as a legitimate period in which to clear the field, then the following computation gives the number of free lanes of travel which should be provided: 3,000,000÷4=750,000 persons who desired to visit the field; 750,000÷5=150,000 automobiles to be provided for; 150,000÷3=50,000 cars per hour to be handled; 50,000÷1,000=50 lanes of travel required.

Street Car Facilities.—Similar methods applied to the trolley transportation, using 100 persons per car and one car per minute would give the required equipment and number of tracks. (For example, assume that one half of the number in the last example had preferred to travel by trolley instead of motor: 750,000÷2=375,000 persons to be accommodated; 375,000÷3=125,000 per hour; 125,000÷100=1,250 cars loads of passengers per hour; 1,250÷60=21 single tracks required.)

Railroad Facilities.—With steam railroad transportation a ten-car train accommodating 1,000 persons per train can be dispatched every ten minutes. (As a further example assume that one third of the people desired to travel by train: 750,000÷3=250,000 persons to be accommodated; 250,000÷3=83,000 persons per hour; 83,000÷1,000=83 train loads per hour; 83÷6=14 tracks required.)

The problem of parking space for the motors and sidings for the storage of trolley and steam equipment is of importance. An automobile occupies 200 square feet on the average. One hundred per cent must be added for access. This gives 400 square feet per motor car. A trolley car requires 500 square feet, and a ten-car train 10,000 square feet. Something more must be added for switches and leads, loading spaces and safety areas. In each case the figure should be approximately doubled. (In the examples above, had one third of the visitors traveled by each of the three modes, the following parking, standing and loading areas would be required: 750,000÷3=250,000 persons by each type of travel; 250,000÷5=50,000 motors to be parked; 50,000×400=20,000,000 square feet=460 acres of parking space required; 250,000÷100=2,500 trolley cars required; 2,500×1,000=2,500,000 square feet=58 acres of trolley waiting and loading space needed; 250,000÷1,000=250 trains necessitated; 250×20,000=5,000,000 square feet=116 acres of steam railroad siding and loading space demanded.) Of course, motor buses

may replace trolleys in many instances and much express and freight will move by motor truck. In exceptional cases, mail tubes may connect a landing field directly with the post office at the business center of the community.

Existing Highways. — Incidentally, while transportation accessibility is of great moment in locating an airport, its creation should be such as to hamper transportation as little as possible to points beyond it. The area required for a large flying field will generally overlap one or more major thoroughfares which would consequently have to be closed. Such closings should be obviated if possible. It is sometimes possible to select a site which is adequate for immediate needs and which can be enlarged progressively by being used as the community refuse disposal site. It is hardly to be expected that regular traffic will ever reach such figures as are now being attained while aviation is a novelty. Plans adequate for the present may, therefore, be expected to be ample for the future.

Emergency Fields.—Pending the future era when a continuous cleared airplane landing strip is provided, numerous emergency landing fields should be arranged, especially in fairly well settled territory like the suburbs of cities. Each of these should have an area of about ten acres and be as strategically located as possible. They should be located at most not over five miles apart, and around cities should be spaced throughout the whole area, at the corners of five-mile squares, or approximately so.

In addition to air ports, standard practice locates intermediate landing fields at intervals of about thirty miles. These should have an area of approximately forty acres and be designed as nearly square in shape as is possible. Their placement demands almost as

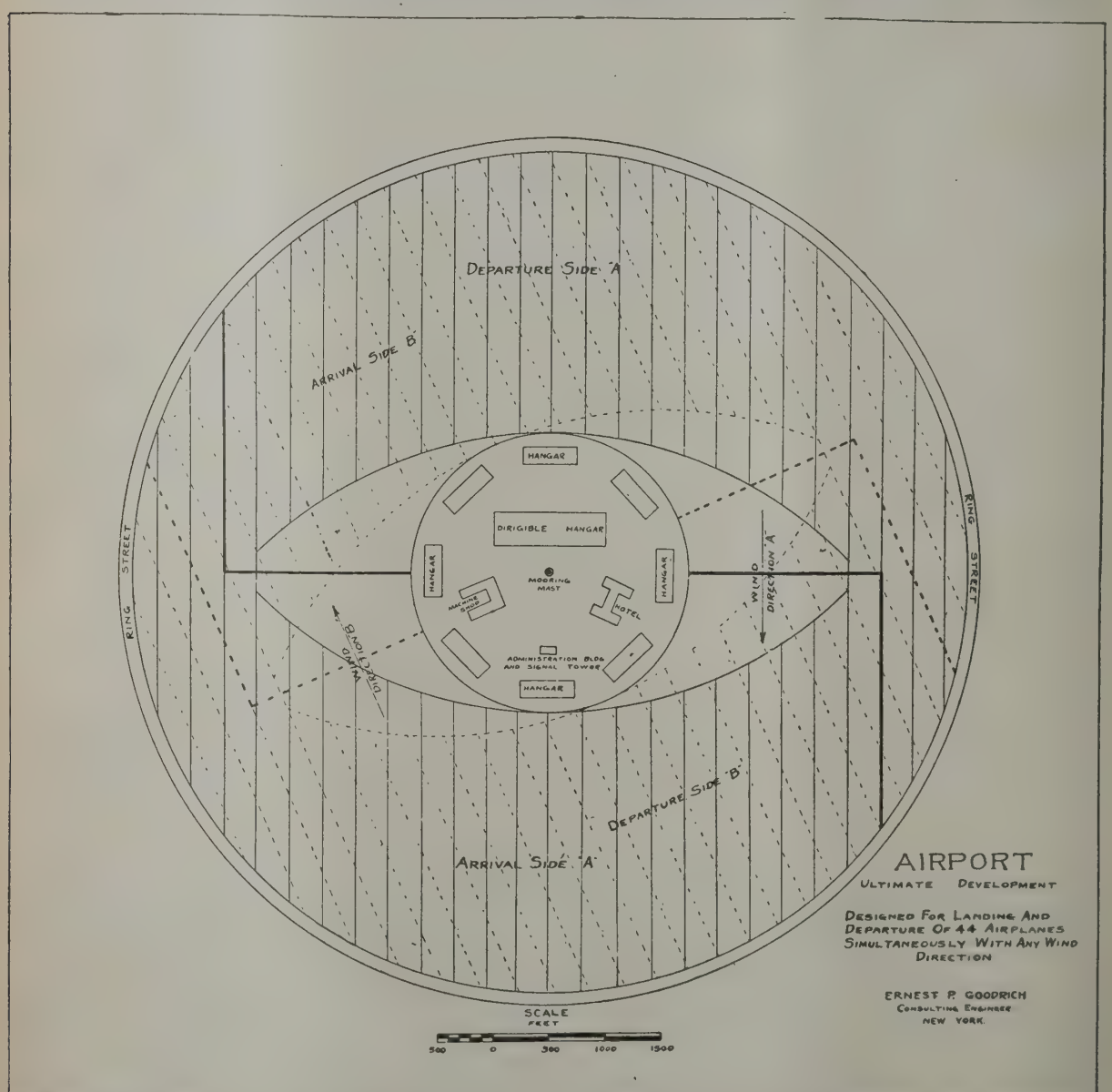


Diagram 1.—The parallel solid lines divide the field into 22 departure lanes and 22 arrival lanes, corresponding to wind direction A. Each of these lanes is 300 ft. wide and 2,500 ft. long. The dotted lines show the lanes which would be used for wind direction B. Note that the mooring mast, shops, hangars and other buildings are located around the center of the field, at the point of maximum conveience, but do not in any way obstruct the runways. The area of this field is approximately 1,000 acres

much study with reference to the city plan as is needed with reference to the larger air ports. Since they are for emergency use only, they may be cultivated with any crop which does not grow high.

Area Requirements.—The areas required for airplane landing purposes should be clearly differentiated from the area required for the handling and mooring of dirigibles and for the several necesary adjuncts. The department of commerce has tentatively determined the area necessary and advantageous and has proposed a classification of airplane landing fields dependent upon the various facilities available. Fields now actively in use vary all the way from 1,000 acres (Mitchell Field) and 700 acres (Cleveland) down to 40 (Boston and Pittsburg), with 25 acres considered the smallest reasonable size for landing except in cases of emergency. Much talke has been heard about roof landing areas, but until new and special designs of planes are common, roofs will not come into general use. Even then, because flying over cities involves extra hazards for both plane and city, roofs are not likely to come into very extensive use for landing purposes.

In rising, an airplane must head into the wind, attain a speed varying from forty to eighty miles an hour on the ground before rising may be attempted. The lighter machines attain this speed rapidly and can, under favorable conditions, leave the ground in from 400 to 800 feet. The heavier planes, those used for freight, mail and passengers, require, under favorable conditions, a distance of from one to two thousand feet before leaving the ground. In addition to the space required on the ground, it frequently happens that the motor stalls immediately after rising, necessitating landing at once. To provide for this emergency, another thou-

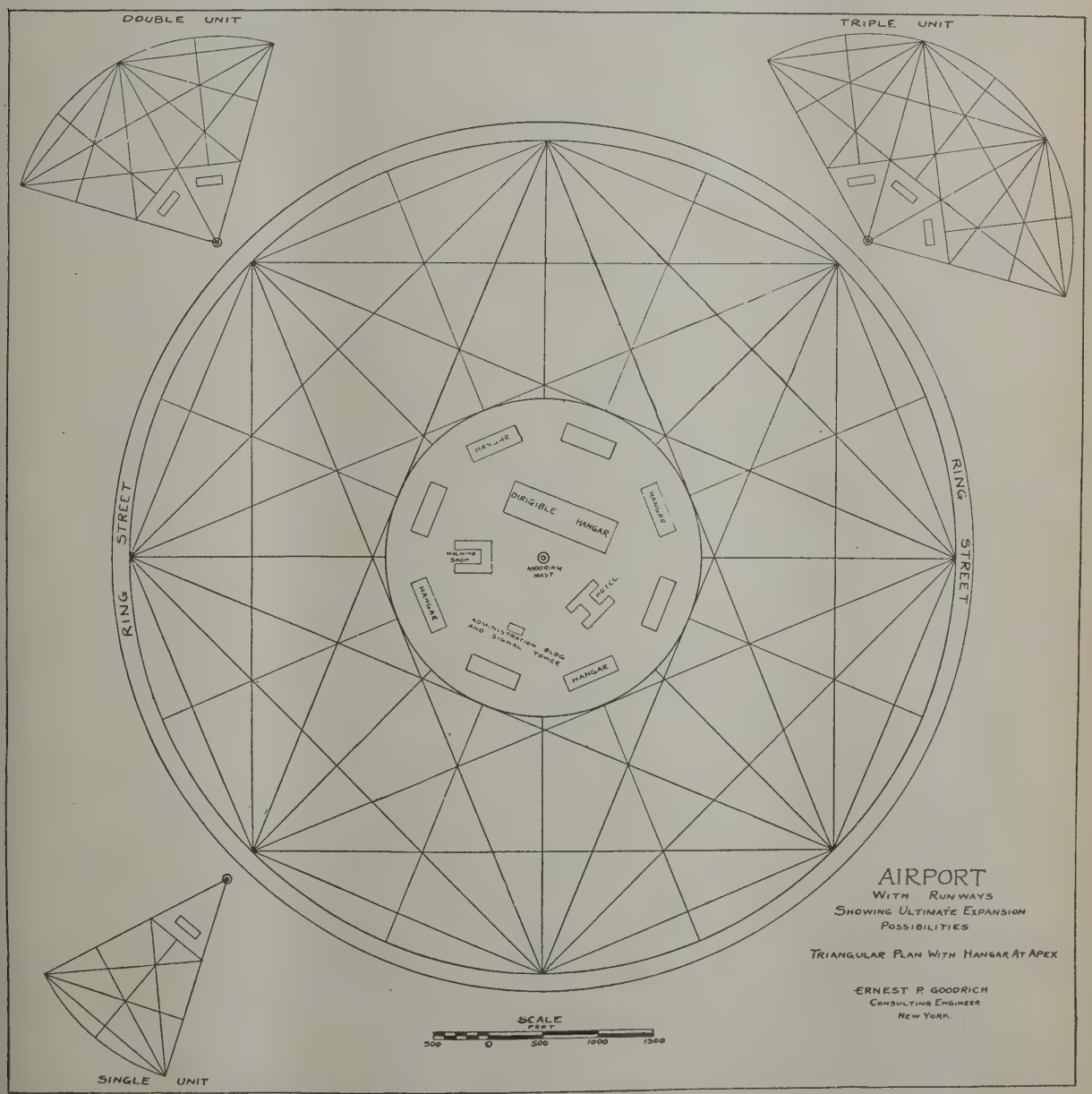


Diagram 2.—Here is an airport that may be started as a small unit and then expanded later as needed. The first unit is shown in the lower left hand corner, calling for an area of 125 acres, with mooring mast and hangars at the apex, and with 8 runways, each 2,500 ft. long, paved or otherwise prepared as required. These runways provide for eight wind directions varying about 45 deg. Succeeding units are easily added as shown, with the complete field of eight such units shown in the center

sand feet is necessary. A total, therefore, of from 2,700 to 3,000 feet is the minimum length of runway, to accommodate all of the now existing types of planes. In rising or in landing, an airplane makes an angle of approximately eight degrees with the horizontal, or for each foot of rise it moves forward seven feet. If there should be a one-hundred-foot building at the edge of the field, it would render seven hundred feet of the field useless. The minimum distance mentioned (2,700 to 3,000 feet) for a runway must, therefore, be increased by seven times the height of any buildings on the edge of the field.[1]

Giant Planes.—Several giant planes now under construction are reported to have wing spreads up to 140 ft. This dimension together with an equal side clearance determines the required width of runway. The projected Junkers model J-1000 is to have a wing spread of 220 ft. Detailed specifications for the classification of air ports have been issued by the department of commerce under date of March 13, 1927.

The requirements for air ports for the use of the future mammoth dirigibles, 150 ft. in diameter and 750 ft. long, have not been as definitely determined. Two such ships moored to towers (with their lofty departure platforms) with space to swing with the change of wind direction would require an area 1,500 ft, by 3,000 ft. a border at least 1,000 ft. wide entirely around the field and additional area for hangars. The latter must be much larger and differ otherwise from airplane hangars.

While most cities are making efforts to provide one large field as near as possible to the business center, it seems better economics in many instances to provide one or more fields suitable for loading and landing passengers, mail and express, fairly close to the center,

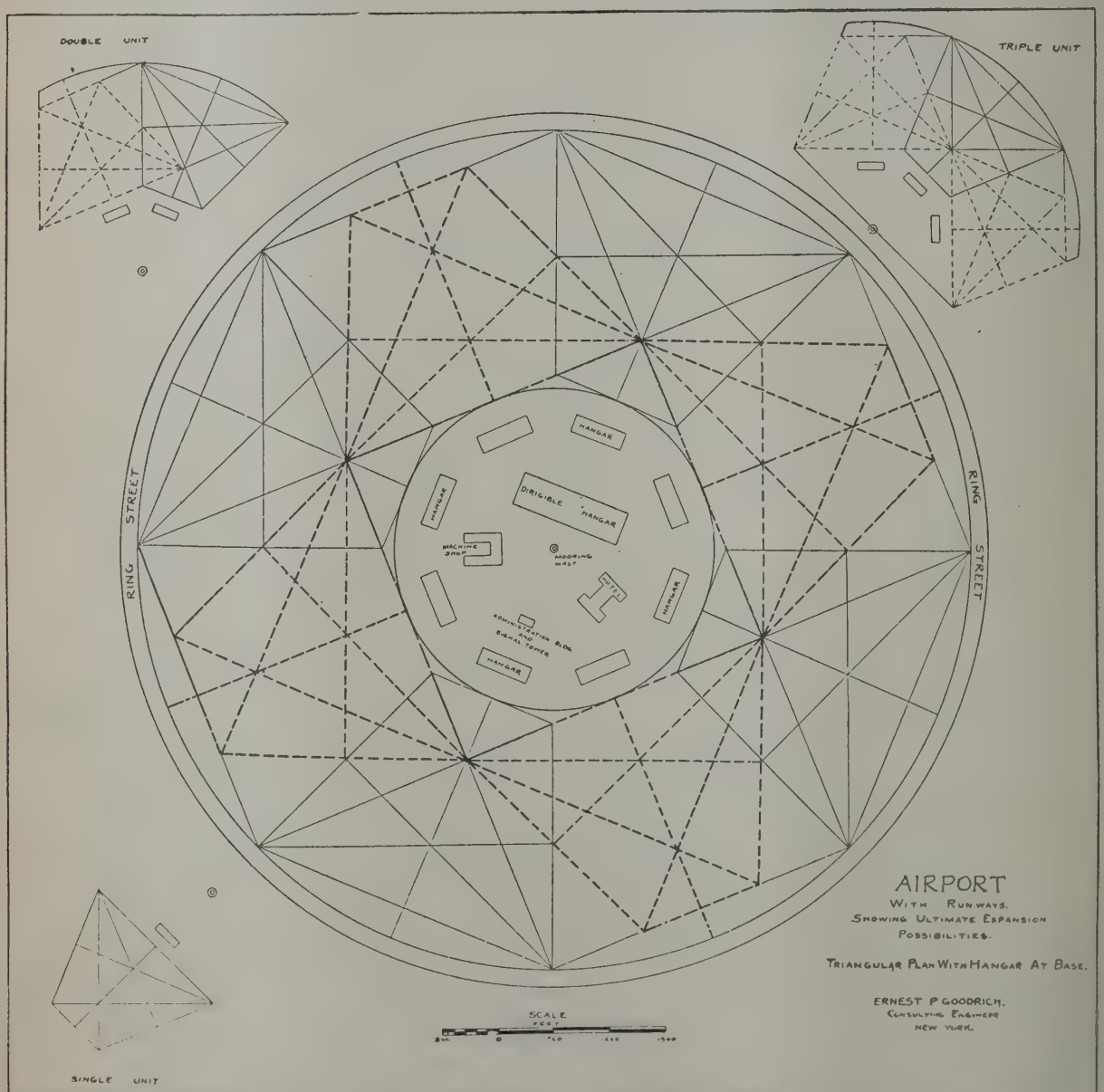


Diagram 3.—The principle of building up the complete airport gradually, by adding units, from time to time, may also be carried out with the hangars at the bases of the units as shown in the above illustration. The finished airport will comprise four such units, shown by dotted lines, and spaced between these will be four other units (shown in solid lines) similar to those in Diagram 2. These two types of units will overlap. The double unit developed in this way is somewhat more flexible as concerns the layout of runways than is the double unit of Diagram 2

with a service field at a more remote and less expensive site.

Factors Influencing Area Needed.—The area required for a field will obviously depend largely upon the amount of use to which it will be put. If ten planes arrive and depart each day, a single runway would be sufficient for use by all. If, however, ten planes are to arrive and depart each hour, it may be necesary to use different parts of the field for arrival and departure respectively and to control the arrivals and departures by a signal system operated by a despatcher as is done at Tempelhof (Berlin). The loading and unloading accommodations could then be placed advantageously at the center of a large field, arrivals approaching this center from one direction (against the wind) and departures taking place on the opposite side of the loading and control station (again into the wind). Since the wind may blow from any direction, the central depot would have to be reached on the surface solely by automobile,—the cars approaching in the same direction as the arrival of the airplanes, from a ring drive which entirely encircles the field and outward from which the thoroughfares and transportation lines would extend. In the case of an extensive, intensively used air port, the automobile and other transit lines might advantageously be brought to the central depot under the surface of the field. While expert pilots will doubtles learn to take off irespective of wind direction (as some do even now in light breezes), there will always be so many who will desire to head into the wind while landing and taking off that it will probably never be possible to ignore the effect of wind in locating and laying out a flying field.

Future Planes.—The area required for the air port of the future will depend in a considerable measure upon the development of the air carrier. Several alternatives seem possible: (a) A machine which can ascend vertically or nearly so, by means of (1) the helicopter principle or some related idea, or (2) a new wing design or arrangement, or (3) both combined; and (b) a machine which will fold its wings after it alights, thereby greatly reducing needed storage space and possibly also being able to traverse existing or special new highways. At Teterboro, not long ago, Chamberlain demonstrated a small plane which kept an even keel when flying at only fifteen miles per hour and required only 60 and 75 ft. of roll respectively to take off and to land. (Most existing planes will stall and drop into a fatal tail spin at a speed of about fifteen miles or less.)

Special Devices.—Devices are sure to be developed to assist in taking off and landing. The compressed air catapult employed for the launching of naval planes, and the decelerating cables which drag bags of sand on the decks of airplane tenders are present-day examples. Perhaps the simplest scheme is to form the surface of the landing field like a flat dome with the depot at the center of the top,—approaching planes landing up the incline and being assisted in stopping by the force of gravity, while departing carriers would leave by sliding down a slope with the assistance of gravity as Lindbergh did (as described in "We"), as Byrd did on his start to the North Pole, and as many others have done from time to time. It is reported that one of the British army air fields used during the war was located on a rounded hill (similar to the scheme here proposed) and that the opinion of the pilots was altogether favorable. Incidentally, the interior of the dome could be used for hangars, for means of access, and for parking of autos, trolleys and other means of land conveyance.

Selection of Site.—From a topographic standpoint, it is now generally felt desirable to secure large level areas for landing fields. (A two per cent grade is considered the maximum.) So as to reduce approach hazards to a minimum, these fields should be chosen as far as possible on hilltops or high ground. This generally reduces ground haze compared with valley sites and the obstructions surrounding the field are not as high as in the case when hills surround the port. Islands, especially artificial ones, if of sufficient size generally possess advantages as to levelness, freedom from approach obstructions, and complete liberty in direction of approach. Accessibility is generally unsatisfactory, however, and they are more apt to be affected by fog. Wherever sea planes can be employed on a route in any direction from a port while land machines operate over other routes, a combined water and land port is considered desirable. However, certain disadvantages inhere in having water ways or water areas as bordering features of a land port because of the incidental hazards to land machines. Larger fields are required under such circumstances. It is believed by many that most planes will eventually be designed so as to alight either on land or water. Obviously, in choosing a site the necessary costs involved in leveling hummocks, doing under-draining, filling ditches, ruts, and sunken roads must be considered, but such work is essential to a successful field. The soil must also be such as to produce a thick tenacious sod and where a practically square or round field cannot be obtained because of topographic difficulty, the greatest length of the area available should extend in the direction of the prevailing winds. In addition to available transportation, electric light and power, water and sewerage must be available or obtainable. Where a sod is unobtainable, concrete, asphalt, macadam or cinder surfaces must be provided. It is generally conceded that when an airplane lands it strikes the ground with a blow equal to perhaps five times its dead weight. Consequently, the surface must be very compact. A dusty field is very objectionable, also.

Length Formula.—At sea level the length of the field at least in the direction of the prevailing winds should, as has been said, be not less than 2,500 ft. plus 7 ft. horizontal space for each foot of height of obstructions at and beyond the boundaries of the field at each end. Greater dimensions are considered desirable if they are obtainable. For altitudes above sea level, longer runways are required. An approximate formula for the necessary length of runway for such an air port is as follows:

$$\frac{10}{\cdot 3}\cdot\frac{A}{C+10{,}000}=\log_{10}\frac{15R}{r}-15\ .$$

In this formula

A is the altitude of the air port above sea level,

C is the A.B.S. ceiling of any plane, for which

r is the take-off length of run on a level field at sea level, and

R is the necessary length of runway at altitude A.

The ratio $\frac{1}{7}\cdot\frac{R}{r}$ is the angle of clearance of all obstructions which must be maintained beyond the runway. The field arrangement and that of the several accessories, — signals, lighting, hangars, shops, waiting rooms for passengers, pilots and workers, field markings, beacons, foggy weather signals, wind indicators, oil and fuel tanks, radio landing control aids and other items,—is not of moment from a city planning standpoint, and the requirements for each of these matters can be found in department of commerce bulletins and technical publications. The lengths required for taking off by sea planes are longer than for land machines and the water areas should be correspondingly larger. To take off, large sea planes require as much as 3,500 ft. clear run unobstructed by such things as bridges, breakwaters, or buoys, with a very flat angle of clearance beyond this take-off stretch. They also require at least six feet of water depth. N. A. C. A. Report No. 249 shows the take-off and landing speeds of nine different makes of plane. They range from 48 to 63 miles per hour at take-off and from 44 to 58 at moment of landing.

A practically smooth surface is thus seen to be necessary. Normally this can be secured by some expenditure, but obviously the site should be selected with this point in mind. The same reports gives the take-off and landing rolling distances, which range from 275 to 505 ft. for taking off and from 200 to 950 ft. for alighting. Unless the surfacing of air ports is such as to minimize the dust, it has been shown that even inside hangars the

[1]Quoted from National Municipal Review, February, 1926, p. 106.

dust will often be so great as to affect the bearings detrimentally. Therefore, the hangars should be placed at the side of the field at right angles to the prevailing winds. With a large field in which the hangars are to be at the center, it is thus seen to be advantageous to have the parked airplanes housed below the surface as would be the case in connection with the dome shaped field elsewhere suggested.

Number and Distribution.—It seems reasonable to expect that eventually air ports will be distributed and be of capacities comparable with those characteristics with existing railroad terminals in the relation of the latter to local population groups. In other words, air ports will be proportional to the population served. Commander Byrd is quoted as saying that "aeroplanes will never be used for popular flying as the automobile is used for traveling." The limiting factor in the development of air carriage will probably be the number of available pilots. Students of the problem suggest that not over 10 per cent of the population possesses the natural capacity to guide safely a vehicle which can move in three dimensions. The licensing of automobile drivers shows that not all persons are capable of operating in two dimensions. Assuming a population of 200,000,000 with 10 per cent capable of operating aeroplanes, there would be a maximum of 20,000,000 possible planes moving around the country simultaneously. Incidentally, the average mileage per year of the present-day motor car is around 600, whereas it would be 60,000 were all cars to be operated at 20 miles per hour for 10 hours per day for 300 days per year. The average automobile is thus seen to be moving only 1 per cent of the time (day time). Or, in another point of view, 1 per cent of all automobiles are moving at all times. They stop and start at least once every day. In fact, the average trip is probably less than two miles, so that there are 20 stops and 20 starts each day for that 1 per cent.

As a first approximation, the same ratios may be applied to air carriers. Of the 20,000,000 possible pilots, 100,000 may be expected to be on the move at all times. With 40 landings and take-offs per day there would be 8,000,000 per day. Assume one every ten minutes for 13 hours, or 80 per day. That indicates 100,000 landings or departures each 10 minutes throughout the country. While landings can obviously be made at shorter intervals than 10 minutes, the time required for the loading and unloading of passengers and freight, the manoeuvering from point of arrival to point of departure, and the signalling to other planes arriving and departing will normally demand approximately 10 minutes as the arrival and departure interval on any given runway.

Population Ratio.—These conditions are strictly comparable with those which hold in connection with passenger and freight railroad terminals. With 200,000,000 population, a landing field or runway is indicated for each 2,000 population. If a factor is introduced to care for a probability concerning air craft like the fact which exists with reference to automobiles, that there are at least 25 per cent less automobile licenses than actual persons capable of driving them, then the figure 2,000 should be increased to 2,500. If only small planes are to be accommodated, this figure can be multiplied by four. For the smallest present type of plane, such as the one in which Chamberlain lately took off from a city street, this figure can be multiplied by 15. Chicago in 1927 had 15 landing fields—seven municipal, six commercial, one army and one postal; Los Angeles had eight, seven being commercial. By states, California had 100 fields, Texas 84, Illinois 64, Ohio 50, Oklahoma 40, New York 30, Arizona 29, Colorado 22, Iowa 24. Obviously the figure of 2,000 persons per landing field does not apply to the present. There are not yet 200,000,000 persons in the United States and there are only about 4,000 licensed pilots in the country, with 2,111 planes listed in the 1927 Aircraft Year Book. With New York's prospective 10,000,000 people, 5,000 such landing spaces would have to be provided. Obviously they should be well distributed so as to minimize air traffic accidents, and a signalling system will have to be employed so that planes can land and take off simultaneously, each on its own 300 by 2,500 ft. runway. A circular field with a diameter of 7,500 ft. would provide for the simultaneous handling of 44 planes with any direction of the wind. Obviously possibilties exist of reducing the assumed ten-minute landing interval, and of securing a greater use of such a field when a type of plane shall have been developed which will require a shorter runway. In other words, an air port of that size and design would afford the facilities needed by a population of from 220,000 to 450,000, according to whether present-day dimensions or future probable ones are assumed. Using the larger figure, it is seen that New York City should plan to provide thirty-five square miles of landing fields to meet its future requirements. The landing fields in the vicinity of New York City for which the department of commerce had issued aeronautical bulletins up to January 1, 1928, aggregated just over four square miles.

Future Development.—As to air transportation we are back in the days of the first railroads when cities and citizens fought verbal battles over the location of the railroad station. The lesson to be learned from the figures is that ample open spaces available for eventual air fields should be acquired and set aside in each community. Until they are required for aeronautics they can be employed as recreation spaces, either active or passive,—athletic fields, wild life preserves, and formal parks. When they are needed for air use, the radius of travel of the average man by motor, rapid transit, or air will make them relatively unnecessary as open spaces. Meantime, if invention eventually eliminates the necessity of such long landing and take-off runways, then the open spaces acquired will continue to serve a legitimate purpose to the benefit of the community.

Special purpose flying fields will be developed and must be considered in regional, if not in city planning. Flying schools must have their fields (in 1925 there were twenty-two such schools); special seaside landing areas will be required to serve the planes which bring ashore transatlantic mails and "rush" passengers; special landing fields along mail routes will be created where a mail plane can drop a mail bag and pick up another either without stopping or merely taxying along the ground and taking off without longer pause; a few down-town landing spaces on the tops of buildings will be developed similar in equipment to the airplane tenders in the Navy; special fields will be made available adjacent to large hospitals where ambulance planes can land; of course, the Army and the Navy will require special fields; and other special uses will develop. The parking near a city of planes owned by flying commuters will be another special problem. Aside from the landing runways required, a hundred such planes would require nearly five acres of parking space. Because sea planes are somewhat larger than the average, one hundred such would require approximately seven acres.

Fogs.—Perhaps inventive genius may some day learn how to dissipate or control fogs, or at least develop neon or other light signals, electric capacity-height indicators, radio direction guides and other aids so that landings can be made in spite of this, at present, dangerous meteorological handicap. Meantime, that site should be selected which is shown to be naturally freest of foggy weather and ground haze. Factory smoke may be as detrimental as ground haze and a field should not have a large industrial district to the windward. Locations exposed to frequent gusty winds are to be avoided, and special measures must be taken when excessively heavy rainfalls are to be expected. Because of the annoyance arising from the noise and flashing lights unavoidable at an airport, the location should not involve a residential district.

As to expense, the Department of Commerce states that current projects may be found to involve a cost of about $100 per capita. Small fields may cost as little as $50,000, while Chicago now proposes an expenditure of $2,000,000.

Algae Control in Uncovered Distribution Reservoir By Chlorinating

Results Obtained and Simple Method of Applying Treatment

By L. B. MANGUN

Chemist in Charge, Department of Water, Light and Power, Kansas City, Kan.

THIS reservoir is part of the distribution system of Kansas City, Kan. It has a capacity of 13,000,000 gal. and is situated about six miles from, and at an elevation of 217 ft. above, the pumping station. It is connected to the city distribution system by a 24-in. main, through which the water both enters and leaves the reservoir. The reservoir is circular in shape with a diameter of 400 ft., giving a surface area of 125,000 sq. ft. of water varying at different times from 4 to 13 ft. in depth, averaging about 8 ft. in summer. It is intended to afford not only a reserve supply but semi-automatically to equalize the pumping rate throughout each 24 hours, as well as between weekdays and holidays. Under normal summer conditions 2,000,000 or 3,000,000 gal. are used out during the daytime and 1,000,000 to 2,000,000 gal. restored during the night. Consequently, beginning with the reservoir almost full on Monday morning, there is ordinarily a more or less steady loss during the week, so that it usually contains less than 5,000,000 gal. on Saturday evening. Over the week-end it is attempted to have the reservoir as full as possible again by Monday morning.

Under these conditions the reservoir is constantly supplied with cool water, rich in diatom food, and with turbidity, color, depth and period of storage all very favorable to algae growth. The season requiring measures for algae control is of about five months' duration, from May to September, inclusive. The growth is most luxuriant during periods of high temperature and bright sunshine, and the heliotropic action of the diatoms, in conjunction with the liberation of oxygen during growth, gives them the buoyancy which keeps them in constant suspension. This algae laden water, at times highly impregnated with tastes and odors, formerly was the cause of much complaint in sections of the city which were reached by water from the reservoir.

Treatment With Blue Vitriol.—The method of Moore and Kellerman for algae control by blue vitriol treatment has given fairly satisfactory results under the conditions obtaining in large impounding reservoirs, especially with waters of low alkalinity, but meagre success has attended its use in reservoirs of other types. Until recently little attention seems to have been given to methods of control in distribution reservoirs of the kind described above. It has been the common practice to empty out the water whenever absolutely necessary, clean, and perhaps spray the floor and walls with blue vitriol solution. By these and similar palliative measures the nuisance was endured until it was ended by covering the reservoir. Thus the problem of algae control in open distribution reservoirs was solved by doing away with the problem itself.

Conditions in distribution reservoirs differ so greatly from those in impounding reservoirs that the same satisfactory results of copper treatment cannot be realized. In the latter a long reaction period is available, only parts near or distant from the point of withdrawal may be treated, and withdrawal may be changed to different depths. In distribution reservoirs there is little possibility of preventing the freshly treated water from entering the mains, the reaction period is short, and though there is a constant change of water, it is not rapid enough to prevent cumulative plankton growth.

Results of Blue Vitriol Treatment.—Nevertheless, prior to last year blue vitriol was frequently used in this reservoir. Saturday evenings were selected as the time of treatment, because the water was low and a given amount of chemical would give the highest concentration, and also because no water would leave the reservoir until Monday morning, 36 hours later, by which time the effects of precipitation and dilution greatly reduce the concentration. Tetrastrum was reduced in number but not destroyed under these conditions by dosages as high as 10 p.p.m. The maximum dosage suggested by Whipple for eradicating the hardiest diatom species is one part per million, and this figure, properly weighted according to the temperature, organic content and alkalinity of this water, is increased to 1.5 p.p.m. However, in the instance of our most drastic treatment, 10 p.p.m. was administered to this reservoir Saturday, July 3, 1926, when 6,000 Tetrastrum per c.c. were present. Twelve hours later it was reduced by dilution to 6 p.p.m., 24 hours later the concentration was 4 p.p.m., 48 hours, 2.2 parts, and Tuesday morning, 60 hours after treatment, when the water first went to consumers, 1.2 parts. At this time there were about one-tenth as many living organisms as before treatment which would be the number that dilution alone would give reason to expect. This dosage appeared only sufficient under these conditions to prevent further growth of these diatoms for two days, but not to destroy them.

The limitations upon the use of blue vitriol in any case are such that it should be considered as a permanent remedy or one that can be continuously used, and since in such a reservoir the necessity for treatment is so frequent it would be impracticable to attempt to keep the water in good condition by this means at all times, even if far more satisfactory results could be obtained from it than is indicated in the instance cited above.

Following the experiments in 1926, reported by Cohen, with algae control by chlorination in two small reservoirs in Texas it was concluded to make trial of the method in this reservoir. The immediate problem in this instance was to find a means of chlorinating the contents of the reservoir, which might at any given time be from 4,000,000 to 13,000,000 gal. of water. The blue vitriol had been applied from a boat, and it was possible to use a floating chlorinating outfit also, as provided by manufacturers for sterilizing small lakes or the larger out-door swimming pools. But the obvious awkwardness of that method in such a reservoir caused a search to be made for something more simple.

Method of Applying Chlorine.—The single 24-in. main which connects the reservoir with the pumping plant and distribution system terminates in a well, situated within the reservoir near the wall. This well has three sluice gates, one of which is at the bottom, facing the center of the reservoir. The second, a few feet higher, faces to the right, and the third, the highest, faces to the left. A test showed that the discharge of water to the right from the second sluice gate throughout the night would gradually set up a rotation of the entire body of water in the reservoir such that by morning, when the inflow ceased and outflow began, the water in the reservoir was moving at a rate of 20 ft. per minute, or nearly one complete revolution per hour. A Wallace and Tiernan vacuum type chlorinator had been connected with this main just outside the reservoir for the purpose of treating the out-going water because

of high bacteria counts following copper treatment, and also for the purpose of destroying as much taste and odor as possible. It was concluded to use this installation for the purpose of treating the reservoir, by allowing the inflowing water to carry the chlorine solution, and to obtain mixing setting up the rotation in the reservoir in the manner above described. Whenever it was desired to chlorinate the reservoir contents, which was done rather regularly about three times a week from July to September during the summer of 1927, the chlorine was fed into the main to the in-coming water during the night, beginning about 8 p. m., and at such a rate as would give the total volume in the reservoir the previously calculated dosage by 6 o'clock the following morning. The concentration of chlorine in the in-flowing water was ignored, although at times it was undoubtedly as high as 20 p.p.m., and would average 5 p.p.m. In other words, the reservoir water and not the in-coming water was being treated. The latter functioned merely as a minor flow for the purpose of treating a larger volume, the sole aim being the application of chlorine sufficient to show a residual in the entire reservoir within ten hours.

Results of Chlorination.—A representative treatment was as follows: A dosage of 1 p.p.m. showed a residual of 0.2 p.p.m. by 6 a. m. at the periphery of the reservoir, and 0.02 p.p.m. at the center. While this indicates considerable lack of uniformity in chlorine concentration at a given time, there is reason to believe that all of the water had received nearly equal treatment, for by 9 a. m., and even earlier on a sunny morning, all traces of residual disappear. Of course the discharge of free chlorine is hastened by photochemical action, but the appearance of the higher residuals is undoubtedly reduced by further diffusion and mixing. Such rapid dissipation of the chlorine indicates the possibility of considerably augmenting the dosage in case of necessity, or even this dosage could probably be reduced if some means of prolonging contact were employed, such as feeding lime or ammonia with the chlorine.

At the time of the first application of chlorine the reservoir water contained 13,000 synedra per c.c., and the suddenness of their disappearance following it was almost magical. At no subsequent time have any organisms appeared which have failed to yield to the treatment, and no objectionable after-effects have been observed. During the entire remainder of the summer not one complaint concerning the water was received from the section of the city served by the reservoir, a new and gratifying experience, indeed, as compared with any other corresponding season since the reservoir was built.

Acknowledgment.—The foregoing is an abstract of a paper presented at the 1928 convention of the American Water Works Association.

The Municipal Radio Station of New York City

The City of New York has for some time been operating a municipal radio station. Some interesting information on the operation of this station is given in "Reporting Municipal Government," a pamphlet issued recently by the Municipal Administration Service. The information, which is based on a memorandum from New York City department of plants and structures, follows:

WNYC, the municipal radio station of New York City, operates on a frequency of 570 kilocycles by authority of the Federal Radio Commission. The station is under the jurisdiction of the department of plants and structures.

From Oct. 1, 1926, to Sept. 31, 1927, 1,689 hours and 34 minutes were employed by WNYC in broadcasting programs. Of this time, 474 hours were given to instrumental selections, 296 hours to vocal music, and 920 hours were devoted to informational and educational purposes. Three hundred and twenty balanced programs were presented.

An itemized statement of the use of the station is as follows:

Citizenship.—The department of education co-operated with the station in securing well informed speakers upon municipal problems and related subjects. A series of eighty lectures was arranged in a course, each speaker being allotted fifteen minutes. Men prominent in civic and industrial circles spoke upon topics covering a wide range of thought. Addresses by leading lawyers were broadcast from the headquarters of the bar association.

Education.—A series of 384 lectures was presented upon educational subjects. By an arrangement between Commissioner Goldman and President F. B. Robinson of the College of the City of New York, the station was utilized by the municipal college as the agency to broadcast educational talks by the faculty of the institution.

Language Instruction.—During the year 208 hours were employed in language instruction. One hour per week was devoted to German, French, Italian and Spanish.

Fire and Police Control.—To an increasing degree the radio is being used by the police department for crime prevention and detection, and by the fire department for fire prevention. The present plan, when fully executed, will result in the installation of a radio set in every police station, police booth and river craft. A description of a robber is placed on the air and in five minutes 7,000 policemen have the warning through 250 stations. Radio reduces a multitude of telephone calls to one general call. Last year 21,239 persons were announced missing in New York City. A description of missing persons is broadcast every evening.

The city's station is utilized to inform people in the work of safeguarding life and property against fire. Fire prevention has been the theme of frequent talks.

Weather and Food Reports.—In cooperation with the departments of agriculture of the national and state departments, WNYC sent out reports concerning the condition of the market in relation to prices and supply of food. These reports were read at stated intervals during the week. Every evening a weather forecast was broadcast for the service of firms handling perishable goods, heating companies, electric light and power plants, orchardists outside the city, and travelers. The value of the service is indicated by the fact that New York annually handles perishable produce in excess of $1,000,000,000 value.

Music.—During the year fifty-seven band and orchestra concerts at Prospect Park and Central Park were broadcast. On Wednesday evening of each week from 8:30 to 10:00 the Adolph Lewisohn course in appreciation of music was broadcast from Hunter College. On each Wednesday morning the organ recital at St. John's Evangelist Church was featured.

Receptions.—Distinguished visitors to New York were received at the city hall from which receptions were broadcast. WNYC participated in the receptions to Colonel Lindbergh, Commander Byrd, Queen Marie, and Senator Marconi.

Cost of Park and Recreational Activities at St., Louis, Mo.

In his annual report, issued recently, Fred W. Pape, Park Commissioner of St. Louis, Mo., gave the following figures on the recreational activities under the directions of the Department of Parks and Recreation: The estimated attendance at baseball games during the past year was 1,975,000, while this form of athletics cost the city only $5,345 to maintain. The estimated cost per person was .0027 ct. Soccer football, it is estimated, drew 1,110,000 spectators. The maintainance cost was $1,985 or .0018 ct. per person. Golf cost the city $33,811, and there were 136,400 games played. Annual permits issued aggregated 593. There were 67,616 nine-hole permits and 29,145 18-hole permits issued. The cost was about 25 ct. a game. The maintainance of the tennis courts cost $12,251, and the number of games played were 206,875. There were 9,081 permits issued and the cost a game 5 ct. The report states 126,310 persons attended the 44 public concerts held. The salaries of the musicians aggregated $9,911. The total maintenance of the city's playgrounds cost $93,939, and the attendance of children during last season was 2,077,591. The attendance at public baths and swimming pools was 1,389,130, and the maintenance cost $78,208. The total expenditures of the Department of Parks and Recreation were $973,082.

The World's Largest Public Aquarium

Construction Now Under Way on Chicago's $3,000,000 Project

CONSTRUCTION work on the John G. Shedd Aquarium is now under way, and with its completion Chicago will have added to her institutions a public aquarium which will be the largest and most completely equipped in the world.

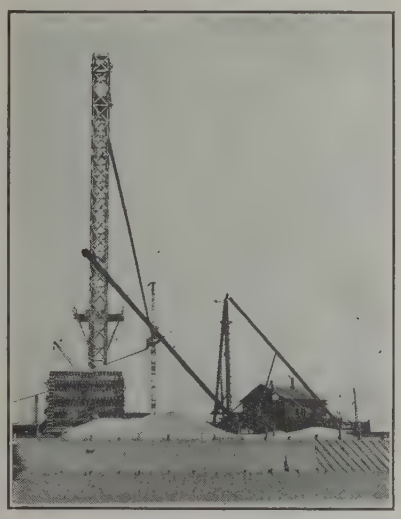
The new aquarium, made possible by a $3,000,000 gift by the late John G. Shedd for the purpose, will be located at the south end of Grant Park in the center of a newly-formed "round point," jutting into and partly surrounded by the waters of Lake Michigan and about 400 ft. northeast of the Field Museum of Natural History. Thus located close to the lake, the aquarium will have a setting particularly appropriate.

General Features.—The architects have designed a building that conforms to the best classical traditions. It will be built in the Greek Ionic style, in the form of an octagon. A central dome rising above the rotunda will be visible from every surrounding approach. The main entrance, through a portico of Greek Ionic columns will face towards Michigan Avenue on the center line of East Roosevelt Road now extended so as to skirt the Shedd Aquarium on the south and connecting with the new South Parkway, which was recently opened for traffic.

The Objects of the Aquarium.—The objects of the Shedd Aquarium will be both exhibitional and educational. So little is known about the denizens of the enormous areas under the surface of the seas, lakes and rivers that the exhibition of water life is a never-ending attraction for the public. Most people are at heart disciples of Isaak Walton and the study of the finny tribes holds for them romance and adventure. An aquarium, where specimens brought from every water can be observed at close range, affords the best place for the study of the aquatic animals.

There are at the present time only five large public aquariums in this country where salt water and fresh water specimens are exhibited, these, named in the order of their relative importance, being in New York, Boston, San Francisco, Philadelphia and Detroit.

The educational work of the aquarium will range from lectures in public schools to highly scientific laboratory work for advanced experiments in marine problems affecting the public at large, sportsmen, educators, and the fishing industry. The plateau at a level 32 ft. above Lake Michigan, upon which the aquarium is to be erected, will be encircled by monumental retaining walls, ramps, and stairways



Plant Placing Concrete for Storage Tanks

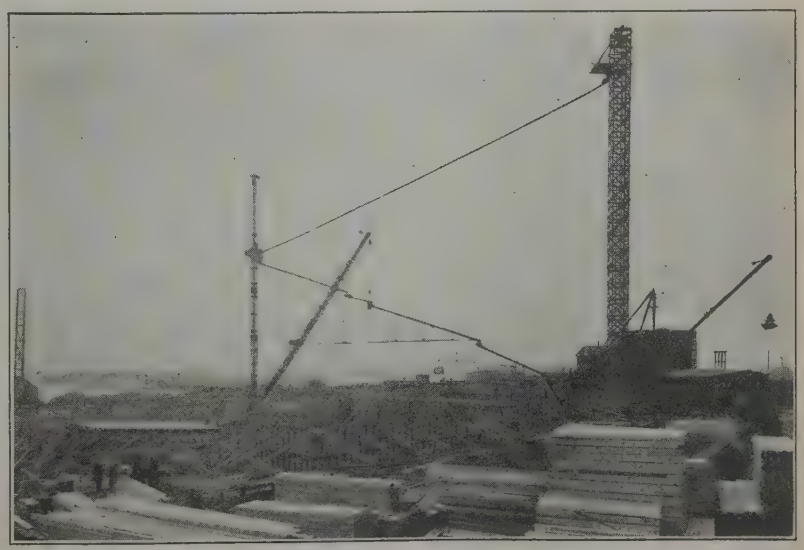
leading down to the lake level. The main floor of the aquarium will rise 16 ft. above the plateau to a level 48 ft. above Lake Michigan. The architecture of the aquarium will be in harmony with the architecture of the Field Museum and of the stadium to the south. The exterior of the building will be white marble. Withal the edifice will be an imposing one, enhancing the architectural beauty of the city.

The rotunda, the main feature and focal point of the interior upon entering the aquarium, will be designed in a dignified manner. Sculpture, bas-relief, and murals of subjects pertaining to sea life will be introduced and the rotunda will be lighted from the sky through a decorative skylight at the apex of the dome. In the center of the rotunda there will be a large circular well with a deep pool on the level of the basement floor which will be treated in a naturalistic manner.

Plans for the interior arrangement of the various galleries call for 1,000 lin. ft. of exhibits to include between 125 and 150 exhibition tanks and sunken gardens, varying in size to accommodate any species of marine life from the tiniest pond minnow to a 10 ft. shark.

Special halls will be maintained for model fish hatchery, balanced aquaria, and fishermen's museum. The hatchery will serve the two-fold purpose of exhibiting to the public modern methods of scientific propagation, and of hatching for the exhibition tanks the eggs of non-transportable fish life.

The usual facilities for the convenience of the public have been provided off the entrance lobby and the spacious hall, such as information booth, check room, and toilets. The balanced aquaria on the floor above back of the portico pediment, as well as the intricate mechanical equipment if the basement will be accessible for public view. A library, lecture room, and directors' office will open off the entrance hall. A large assembly hall will be provided in the basement, also the necessary mechanical and refrigeration plant, receiving and storage rooms and tanks for the various fish, which will be dis-



General View of Concrete Placing Operations for Storage Tanks at Shedd Aquarium

tributed in containers to the main floor exhibition tanks by means of elevators and overhead track system.

Storage Tanks.—In the basement will be 16 large concrete tanks for the storage of waste needed for the exhibits and hatchery. Rail facilities needed for shipments of water to the building were extended for the use of the contractors. A drive will enter the basement on one side and pass around to the other side affording opportunity for truck deliveries. An intake in the lake will afford a good supply of fresh water for condensing and exhibition purposes. No heating or lighting equipment will be needed, since such services are to be secured from the Field Museum by means of a conduit tunnel to be excavated and lined with concrete, passing under the drive to the basement of the museum. This floor will also contain brine cooling rooms, transformer room, switchboard room, pumps, etc.

Service Equipment. — The great quantities of water that must be handled, together with the cooling and aerating systems, make it necessary to install a great many specialized electrically operated pumps. For instance there are 3 pumps of 125 G. P. M. needed to handle tropical salt water, two at 75 G. P. M. and one at 50 G. P. M. needed to handle cool salt water, two at 50 G. P. M. and one at 75 G. P. M. needed to handle refrigerated fresh water, three at 125 G. P. M. to handle natural fresh water, plus two house pumps at 150 G. P. M. each, a 35 G. P. M. pump for the tropical pool, and two condensing water pumps at 600 G. P. M. each. There are to be about 50 electric motors from 1 to 150 H. P. for various purposes. Two gas fired boilers will be required to supply 2,500 sq. ft. of radiation and to raise the temperature of 6,000 gal. of fresh water 30 deg. per hour, and 15,000 gal. of salt water 15 deg. per hour from 45 deg. to 60 deg. respectively.

These points will give some idea of the magnitude of the job, as will the statement that the storage capacity of the basement tanks will be such that about $45,000 worth of water will be kept on hand at all times.

The architects for the John G. Shedd Aquarium are Graham, Anderson, Probst & White, Chicago. R. C. Wieboldt Co., of Chicago, is the general contractor.

How the Average Citizen Judges Municipal Government

Extract from the introduction to report "Measuring Municipal Government," by Clarence E. Ridley, published by the Municipal Administration Service.

Municipal government is constantly being measured or judged. Someone calls up the city hall and enters a complaint because a catchbasin on a certain street corner is flooded. A few days later the same person calls to report that nothing has been done about the complaint. "This administration is terrible," are likely to be his first words over the telephone.

If you were to ask the complainant how he knows the present administration is terrible, he would say either that the previous administration never overlooked such complaints or that the previous city he lived in never allowed its catchbasins to clog up. Although the city deserves to be censured for laxity, the unfairness of such a basis for comparison is evident. There may have been a good excuse for the apparent neglect of the complaint. And, even if there were no excuse, a single mistake or error is hardly a sufficient basis for condemning the work of an entire city administration. On the other hand, someone else may have received prompt attention to an equally trivial complaint; he is loud in his praise of the entire government. Certainly no administration should be appraised in its entirety on such insufficient grounds.

Occasionally, other more objective criteria will be applied. The physician will examine the death rate and perhaps appraise the entire city government as good or poor from this one fact. The club woman, interested in public welfare, will base her conclusions on the adequacy or inadequacy of poor relief. These are mere segments of the great circle of activities in which a city is engaged. To draw conclusions from too few data is as likely to turn good men out of office and let rascals in as it is to turn the rascals out and put good men in.

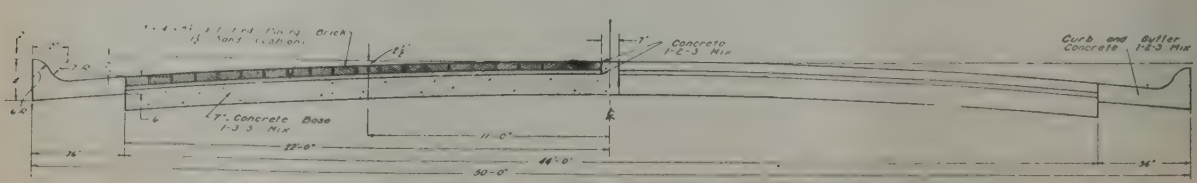
As Munro points out in his chapter on the criteria of good city government: "Two-thirds of the citizens know nothing about the tax rate. They are not property owners, and although they pay taxes indirectly (through landlords and merchants), most of them do not realize the fact. And as for the efficiency of the various city departments —such as police, fire protection, public works, schools and all the rest—the average citizen can see but a small part of the work and even as respects this small fraction he is hardly competent to form an opinion of his own."

For a number of years those interested in good government have been trying to develop some comprehensive means of measuring the work which cities are doing. So far they have developed few significant criteria. They have, however, laid a foundation on which future criteria will be based. They have proved that the element of personal judgment must be eliminated to a large extent before measurements of much value can be established. The best criteria are and always will be those whose worth does not depend on the way they are used. They should yield the same results for a given community regardless of who uses them or how they are applied. Of course this is an ideal. Probably the personal element can never be completely eliminated.

Methods of Water Analysis.—The methods used by the United States Geological Survey for analysis of the mineral content of waters are described in Water-Supply Paper 596-H which has recently been issued. This 27-page pamphlet is for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at the nominal price of 10c.

50-Ft. Brick Pavement Has Concrete "Curb Traffic Marker" in Center

A brick pavement constructed last fall on South Main St., Rockford, Ill., has a concrete curb down its center. This served as a guide for the turnplate and now acts as a traffic marker. The pavement is 50 ft. wide and of the section shown in the illustration. The curb is a 1:2:3 mix. It was painted with whitewash before the asphalt filler was applied to the brick. This prevented the asphalt from sticking to the brick. The filler was heated to 390° and applied by the filler pot method. The concrete base is a 1:3:5 mix and only enough water was used to make the mass washable. B. C. Harvey, City Engineer, was the engineer, and A. E. Rutledge, Rockford, Ill., the contractor.



Section of Pavement on South Main St., Rockford, Ill., Showing the Concrete Curb in Center

Forethought in Planning for Future Developments of a City

How an Indiana City Has Solved Some of Its Problems

By D. B. DAVIS
City Engineer, Richmond, Ind.

IN THE proper plan of a city, the streets and pavements naturally act as the arteries and veins, through which transportation ebbs and flows. Like the veins of the human body, some must be larger than others, depending upon the volume of work to be accomplished. It seems then just as absurd to have too wide a roadway in a purely residential district, which would automatically attract commercial traffic and endanger the play of children, than it is to have too narrow streets in the congested business areas.

In the plan, there should be the main arterial highways and the minor ones which feed the traffic from the local centers along its length. Arterial highways should run as direct as possible, that the traffic flow, both from the county and state routes as well as from the local areas, may reach their destination in as safe and short a time as possible. The width of these will naturally depend upon the importance and the size of the community. Detroit and other large centers see a need for super-highways of a width of 220 ft., while the average city will be adequately served by widths from 80 to 100 ft.

When cities were smaller, many of the better residences were built along what has developed into through traffic routes, bringing with it a constant stream of transportation, both freight and passenger cars, with their noises and odors and speed which proves so hazardous to the lives of children.

The main street of many of these cities is usually one of these arterial routes, so consequently we see a gradual desertion of many fine homes along these streets to places more removed from confusion.

The Atmosphere of Cities.—All cities automatically provide themselves with the fundamentals of livelihood, but tell me what makes some places more attractive than others? What is that something, that on driving about a city that makes you say, "If I ever make a move I am coming here to live"? We may not be able to define it, but it may, in part, be a sense of orderliness and proportion that we feel and so admire. There is a distinct atmosphere about cities, just the same as of individual homes; when you go in them, either you feel welcome there and a desire to stay, or you wish to hurry off at your earliest convenience. The thing which we officials should seek to accomplish is to give that feeling of comfort and joy of living to our citizens, by the proper arrangement of its utilities.

The one thing which makes some cities progress above others, is due to an unselfish co-operation on the part of its citizens. Pity the city or individual in which no dissatisfaction regarding its welfare exists, for there you have an end to improvement.

It is possible to secure an excellent city if the citizens and officials exercise sufficient forethought in its development and administration.

It is comparatively simple to plan and build a new city, but the reshaping of an old one to fit changed conditions presents many knotty problems.

The City Plan Commission.—To bring the supervision of city planning to an issue and make it some one's particular job, many cities have created a city plan commission, whose purpose is to look into the future to foresee and arrange for the needs of a larger city, without unnecessary disturbance of the present one.

It is the aim of the commission to assist and by suggestions as to ways and means to bring about the development of undeveloped property. They desire, in the plats presented to them, that the streets be arranged in such manner that they lend themselves to the use proposed to be made of them and that they be as nearly coterminus as possible. They do not, however, encourage as wide a roadway for purely local residential sections as on main highways leading into the city or on main cross streets designed to carry a large volume of heavy traffic.

Wide Easements.—Wide easements, meaning total width of roadway, sidewalks and grass plots, are, however, desirable in residential as well as commercial sections, for the better beautification of the street by means of plantings. These wide easements surely lend a sense of freedom which is universally felt. One of the most important things to be accomplished is to get these wide easements while the land is vacant and unimproved. Richmond just completed a street widening along an addition laid out before a plan commission was in existence. The addition abutted against a section line road, leaving it only two rods wide. The most economical method to widen was to take a 40-ft. lot off of one side of the street, but even then it caused the removal of three houses and cost over $12,000. How much easier it would have been to have looked to the future when the plat was made out. Plan commissions which function at all will save the city many thousands of dollars and considerable worry in the future.

There is, however, an idea on the part of some, who think because there is a plan commission in a city that it is a panacea for all city ills. Few appreciate how limited is the authority given them.

Building Set-Back Lines.—Great saving can be accomplished in securing wider easements in business areas by the establishment of building set-back lines. This allows the desired widening to be accomplished over a period of time and at the least inconvenience and cost to the city and abutting owners.

A law was passed in Indiana in 1925 regarding set-back lines, but it does not apply to cities lower than second class. If any city needs such a law and if we are to profit by past mistakes, by deferring street widening until expensive structures have been erected, it is the smaller city which needs the law. In smaller cities the structures along the streets are of lower value than when they are replaced to accommodate the greater patronage coming with the enlarged city. Hence the time to establish set-back lines is in the early stages of the city.

In Richmond, in order to prevent loss of an opportunity to widen streets where new buildings are contemplated, the building commissioner is instructed to issue no permits where such contemplated building is to be located on a corner lot, without first bringing the matter to the attention of the board of works and the city engineer.

If it is found that the street is one which is planned to be widened, the board of works, with the city engineer, invite the owner into a conference upon the matter. A visit or visits, as may prove necessary, are made to the site and statements of purposes are made.

The purpose of the city in asking for a wider pavement is frankly stated to the owner. The city officials state their case in the most friendly manner, explaining problems of traffic, brought about by the ever increasing number

of motor vehicles, the need for increased parking space; reminding the owner of their duty as officials to look forward to the future need of the citizens; appealing to his sense of civic pride to assist them in that duty, yet all the while appreciating the owner's position and keeping in mind his side of the question. In this friendly yet businesslike way, is the matter brought along until the question of damages to the owner is reached.

Determining Damages and Benefits.—At first, some owners have an exaggerated idea of the amount of damages due them for a few feet of their property. It is, of course, perfectly human to endeavor to secure for themselves as much as is possible, especially from a corporation, which is erroneously supposed to be heartless.

Two methods of determining damages and benefits are explained to the owner, one which may be termed the legal way and the other which is the friendly or amicable way.

The legal way, which varies according to statutory procedure, and is more or less understood by officials. This is the customary method employed to widen and secure easements, but it has such a harsh and impersonal touch that, afterward, there seldom exists a friendly feeling between the parties concerned. Each one imagines the other has taken an unfair advantage of him.

In contrast to this legal method, is the amicable one, where the interested parties discuss the problem as heretofore stated, and come to an agreement without condemnation proceedings.

The proposition is made to the owner that in consideration of the dedication to the city of a strip of land, the width of which varies from 5 to 10 ft., the city will bear all the expense for reconstructing the walks, curbs and pavement. The work of reconstructing the pavement is done by the city forces under the street commissioner, thereby saving all unnecessary expense to the city.

In this plan, the officials in dealing with specific cases, not only want to feel that the owner is getting an equitable settlement, but we desire that the owners themselves will feel likewise, and when the thing is accomplished and it is as you know, invariably a wonderful civic improvement, there will still exist a friendly feeling on all sides. The owner is as proud, and deservedly so, as any one concerned in the matter.

Annexation.—There is a divided opinion regarding the advisability of adding to the city by annexation. I firmly believe in the idea of a city protecting itself by having a wide strip of open land about its developed territory; that it may exercise the necessary control upon its future growth. Notwithstanding the control of platting by the city plan commissions within a radius of five miles, the proper and complete control cannot be had when the land lies outside the city limits.

European cities formerly protected themselves by high walls and deep moats, but these now are occupied by circumferential boulevards following the route of these old walls. Civilized cities are putting their dependence in city plan commissions instead of walls and moats.

If we are to develop a high standard of living, all territory to be used for city purposes should at once receive the improvements to the land necessary for the use designed.

Sub-Divisions.—Wherever a city exists which is moving forward, there is to be found a horde of promoters ready to encourage the owners of open land to sub-divide it for speculative purposes. Many acres of good productive farm land is each year uselessly divided into lots, to lie vacant for years to come, yielding only an abundant crop of rank, obnoxious weeds to be cut and burned.

Sub-divisions laid out without improvements are naturally of lower value and consequently attract a lower class of structures than would come with the natural growth of the city. It also permits a scattered development, requiring a large amount of pavements, street lights and public utilities to serve a limited population.

If promoters were required to put up the necessary funds for the improvements to each lot, there would be less inclination to sub-divide unless they could see a real demand and sale for the lots.

It is just and proper for a city to expand but it should be done compactly and uniformly.

If boundaries are not laid along water sheds, it hinders the construction of drainage and sewer systems along economical lines. Under existing Indiana laws, sewer assessments are made on a square foot basis to benefited property. Trunk lines should be designed to care for the ultimate contributing territory, whether it be within or without the city limits. If only one-half of this benefited area is within the limits and the sewer is constructed, that part is penalized for the one-half cost lying outside the city; coming in later and connecting with the trunk lines without paying their share of the cost.

These sewer trunk lines should be constructed as far as there is any show of growth and use to be made of it; this same principle should apply to other city utilities such as pavements, water mains and electric service. The first thing asked by these selecting sites for new industries is the proximity of these utilities.

Utilities in 1 Sq. Mile.—It is of interest to see what cost is added to the city for the services paid by them from the general fund. To arrive at this I have taken a typical section in Richmond, 1 mile long and ½ mile wide and noted the items for which the city pays. These are listed below:

Utilities in One Square Mile of City	
16½ miles 6 in. water main	
1 mile 10 in. water main	
1 mile 12 in. water main	
1 mile 16 in. water main at 1 ct. per inch	$7,233.00
108 fire hydrants at $12.50	1,350.00
164 arc lights at $43.00	7,052.00
Collection of and disposal of garbage	2,151.00
Collection of and disposal of rubbish	5,146.00
Total	$22,912.00

Improving Vacant Plots.—In most cities, there are sub-divisions scattered here and there, where the major portion of the lots remain vacant. Often these plots occur in outlying districts where the present value of the lots are comparatively low. To have these spots remain unimproved, with the possible attraction of inferior structures, reflects a detriment to adjacent property.

For this reason, we in Richmond, make an effort to encourage some type of pavement construction for these plots.

We realize that these lots cannot stand to have the highest type of paving laid at once, so we have evolved a type pavement which has proved successful to us, yet inexpensive.

This type includes the use of 2 in. of cinders spread and rolled into the sub-grade. This acts as a stabilizer to the clay which prevails in our district. On top of this is spread a layer of local gravel to a depth of 5 in. To expedite the compaction of this gravel, 2 in. of crushed stone dust is spread and harrowed into the gravel and after being thoroughly wet, it is dragged and rolled alternately until hard and smooth. This foundation employs local materials and inasmuch as it resists no abrasion, furnishes a very stable base. For a surface 4 in. of No. 1 crushed stone is spread and waterbound. To protect it against dusting, we apply 1 gal. of tar per sq. yd., in two applications, and cover each application with No. 6 stone chips. After the final spread of chips, the surface is rolled. The cost of this pavement is $1.60 per sq. yd.

This pavement presents a very nice appearance and gives excellent service. After the street becomes built up with residences and they desire a higher type pavement, it is an easy matter to lay a bituminous resurface and the total cost, both of the initial pavement and the resurface, will not exceed the cost of some original modern type pavements.

For pavements receiving heavier traffic, Richmond is laying reinforced concrete pavements. These concrete pavements are built 8 in. in thickness and reinforced with 52 lb. of metal. A center joint is constructed with transverse joints every 50 ft. Richmond is a pioneer in using concrete for roadways, having laid their first job in 1896, which is still giving service.

Planting of Shade Trees.—Three years ago the Board of Works realized that if the beauty of its new streets were to match up with those of the old city, they must take some action to

have shade trees planted. Consequently, with each new street improvement, the item of shade trees is included. These trees are planted approximately 35 ft. apart and are of the same variety throughout the improvement. A 3 year guarantee is required.

The importance of street trees is far reaching. Their presence is the beauty of the street. Their absence causes defects to show up, such as buildings in disrepair, unsightly structures, which are seldom noticed when shade trees are present.

After the setting of shade trees, there is still a deep responsibility to the city for the care of them. Many cities have recognized this and have inaugurated the necessary rules and organization for city forestry work.

It requires many years for the maturity of shade trees even when they are properly cared for. Why should cities then defer the creation of forestry departments when they are of such vital good to the city?

Three years ago, the city plan commission secured options on all but one piece of land bordering a small creek just west of the corporation line. This land was low and mostly unsuitable for residences, but would make excellent park property. They knew it was but a year or so before the city would extend its boundaries and this creek would act as the natural water course for the storm water for that district. The land was purchased for $100 per acre; one piece having to be condemned at $150 per acre.

Since then the city has annexed territory ½ mile west of this park land and we are now ready to receive bids on a sanitary sewer 8 miles long over the entire district. Many buildings are being erected and soon it will be a regular part of the city.

If the city had not bought the low land where the creek flows, they would have been required to construct a storm sewer ¾ mile long, approximately 6½ ft. in diameter to care for the drainage. In other words, the city secured 35 acres for a park, which lies in the center of a residence district for approximately $3,500 and saved $40,000 on a storm drain.

A recent street widening finally consummated cost 15 per cent more by deferring it three years. This was caused by the district getting a factory and values increasing. The thing had been forseen and proposed early while values remained low but was retarded by objections.

Individuals and cities should profit not only by their own but by observing others' mistakes; if we do, they have proven profitable to someone, but if we make the same mistakes over and over, we have incurred great losses.

Civic progress is like a relay race; the work of one administration starts off where a preceding one leaves it; if it can become co-ordinated, real results will follow.

These accomplishments cannot be attained, however, by rubbing an Aladdin's lamp; like human character, it must be started early, persisted in and encouraged to attain the ultimate ideal.

Knowing as we do, that environment will determine to an extent, the conduct and well being of the people; it is our duty, as public servants, to raise the standard as high as we can, and though we cannot see the consummation of our plans, it may prove as an incentive to those who follow after us.

Acknowledgment.—The above is an abstract of a paper presented at the 14th Annual Road School.

A Sanitary Ash, Garbage and Refuse Collector

It is generally agreed that sanitation is the most important factor in the collection of refuse. Unsanitary methods of garbage collection endanger the health and welfare of the whole community.

A recent design of sanitary refuse collector is illustrated below. In this collector a 10-ft. trough comes down to the curb, receives the garbage, and lifts the contents into the body of the truck through a mechanical apron. All dust, garbage and refuse and odor are confined until the ultimate end of the journey. One man easily and quickly handles the loading, without lifting strains. The moment the truck leaves the curb the trough is back in its place and the contents confined.

This collector has been placed on the market by B. Nicoll & Co., 292 Madison Ave., New York City. It is made in two types, the dimensions being as follows:

Type	A-1	A-2
Capacity of body	10 cu. yd.	15 cu. yd.
Length of body	12 ft.	13 ft.
Height of body	4 ft.	4 ft. 6 in.
Width of body	6 ft.	7 ft.
Height of body from ground	10 ft. 10 in.	11 ft. 2 in.
Capacity of bucket	1 cu. yd.	1 cu. yd.
Length of bucket	10 ft.	10 ft.
Height of bucket	20 in.	20 in.
Width of bucket	22 in.	22 in.

Cold Weather Operation of Filters at Bangor, Me.

The following note on the winter operation of the filtration plant of Bangor, Me., is extracted from the 1927 report of James M. Caird, Chemist and Bacteriologist of the plant:

"At times of extreme cold weather ice has been formed in the rear of the filter units, under the concrete deck, but this has been overcome by reducing the 'head' of the water on the sand beds, which permits the air to circulate freely under the filter decks. In operating the filters during the cold weather, it is necessary to wash them every six to eight hours, otherwise they become 'air-bound' and permit undesirable water to pass. The 'air-bound' conditions commence when the temperature of the water is below 45° F. When the water is warmer it is possible to operate the filters from 16 to 24 hours between washings."

Recreational Facilities at Detroit, Mich.

The per capita cost of the recreation system of the city of Detroit was less than 8 ct. per capita in 1927. In that year 7,500,000 people attended recreational activities at the 31 playgrounds and playfields. The city now owns 549 acres of recreational areas, not including parks. Of the people using the playgrounds in 1927 42 per cent were adults and 58 per cent children.

New Street Signs at Portland, Ore., and Toledo, O.—Portland, Ore., has authorized the purchase of 9,000 new street signs. This is the beginning of a four-year program of 9,000 new signs per year at an expenditure of $40,000. Toledo, O., will spend $25,000 for new street signs in 1928, and a like amount next year, if the present program is carried out.

Front View with Bucket Down. Bucket Raising—Dual Control by Loader or Driver. Dumping—Driver Controls Rear Door and Body Raising. Dumps at 45° Angle

Concrete Aggregate Produced While Digging Plant Site

Ingenious Use of Equipment in Building Sewage Disposal Plant

IN the construction of the Imhoff tanks for a new sewage disposal plant for the city of Dayton, O., the E. H. Latham Company of Columbus has an ingenious equipment layout that ties together in a simple and effective manner the operations necessary for making the excavation, obtaining the aggregates for concrete, and placing concrete in the forms.

The excavation required for the Imhoff tanks on this project is approximately 250 ft. long, 250 ft. wide and 20 ft. deep. The site of this excavation is, by good fortune, on a deposit of excellent sand and gravel. Since considerable quantities of these materials are needed for later concrete work, it was only natural to save the material from the excavation and to include a small screening plant in the equipment for the project, so that the sand and gravel could be properly prepared for concrete.

The sand and gravel is covered by an overburden of approximately 5 ft. Below this, however, there is left some 15 ft. of excavation through the usable material.

Gravel From the Excavation Is Dumped Into a Movable Hopper in Front of the Traveling Head Tower

For making the excavation itself, the Latham company is using a 1-cu. yd. Sauerman slackline cableway excavator. The placing of the mixed concrete, after the excavation has been completed and the forms placed, will be done by a tautline cableway and concrete buckets.

To simplify both of these operations, the company installed two movable towers that are moved along the sides of the excavation. These towers are now being used to support the Sauerman cableway while the excavation is being made, and they will serve later to support the tautline cableway while concreting is in progress.

The towers are built of wood, supported on rails, and are of a standard design for the operation of a tautline cableway. The slackline cableway excavator, however, was easily adapted to this anchorage. The head tower supports the 2-drum hoist operating the slackline, as well as the mast-top assembly of operating blocks. The lower end of the slackline cableway trackline is attached to a bridle at the base of the tail tower. When the tautline is installed it will be attached, of course, to the peak of each of the towers.

Since the slackline cableway is moved along the excavation as fast as the work progresses, it was not feasible to build the screening plant so that the cableway could discharge directly to it, as in the usual installation. The material from the pit is being handled very easily, however, by means of a movable hopper which receives the load from the cableway bucket.

This hopper moves on rails between the excavation and the head tower, as shown in one of the illustrations. Under the hopper is a narrow-gauge track, and small industrial cars receive the sand and gravel from the hopper and carry it to the screening plant at one side of the construction site. The screened materials are being stored in large piles and will be reclaimed later when the concrete mixing begins.

The E. H. Latham Co. was awarded the Dayton sewage plant contract only a few months ago. The excavation for the Imhoff tanks began early in the spring, and as this article is being written is practically completed. The Sauerman cableway, operated on a span of 400 ft., has averaged about 350 cu. yd. of material per 8-hour day, and has made records as high as 470 yd. a day.

Excavating for Imhoff Tanks at Dayton Sewage Disposal Plant. The Pit Will Be About 250 Ft. Square by 20 Ft. Deep

Softening Municipal Water Supplies By Use of Zeolite

Experiences at Two Large Scale Plants in Pennsylvania

By J. T. CAMPBELL and D. E. DAVIS
Of the J. N. Chester Engineers, Pittsburgh, Pa.

ABOUT four years ago the Ohio Valley Water Co. authorized its engineers to report upon a plant for softening the water supplied by that company to a suburban population of 60,000 people on the Ohio River just below Pittsburgh, Pa. The water delivered averaged about 3,200,000 gal. per day and is derived from wells drilled in the river channel to bed rock through 30 to 40 ft. of sand and gravel, which has been deposited in the rock-cut channel of an older river.

The water from this underground source conforms to the characteristics of a true ground water, and is generally about twice as hard as the river water flowing immediately above.

There is apparently very little direct and immediate communication between the river water and the underground flow, as is indicated by the chemical characteristics of the two waters, and also by the fact that the well water is comparatively pure while the river water is highly contaminated.

Quality of the Water.—The quality of the water and its variations may be noted from Table I:

It will be seen that the soap hardness averages somewhat over 200 ppm. The hardness of the City of Pittsburgh water as taken from the Allegheny River is more nearly 80 ppm. and the contrast was sufficiently marked as to offer occasion for considerable complaint on the part of the users of the harder water. However the markedly high manganese content (over 2 ppm. as Mn.) brought forth the major portion of the registered protests from housewives, because of the discoloration of clothes during laundering, and the staining of porcelain fixtures.

The manganese was also a source of trouble and expense to the water company since it tended to become deposited (as M_nO_2) upon its mains and particularly in its service lines, often stopping the latter completely, and threatening to seriously curtail the carrying capacity of the lines.

The goal set for the proposed improvement therefore looked to the elimination of the iron and manganese content of the water as well as that of supplying the consumers with a softer product.

Zeolite and Lime-Soda Processes Considered.—A zeolite softening plant for the treatment of the boiler feed water for this plant had been in successful operation for about two years prior to the time when studies were begun for the softening of the entire supply, and due to the favorable impression which this installation had made on the management, it was suggested by F. B. Beech, the general manager, that this method as well as the lime-soda process be considered. Space considerations entered into and affected the calculations since the plant was located at the head of Neville Island, and occupied the larger part of the land there owned by the company, so that there was comparatively little room for the construction of new facilities. The lime-soda process, as conceived, would have involved some form of sedimentation and chemical storage facilities as well as filtration. In contrast, the zeolite plant could be constructed and housed over a concrete chlorination basin already in existence, and the chemical storage problem conveniently and economically solved by building concrete brine tanks with tops a little above ground level into which salt could be shoveled from boxcars set on the railroad switch paralleling the tank.

The comparative cost estimates for the two projects based on a four million gal. per day plant showed that there would be no great difference in first cost between the two plants, and that an expenditure of about $100,000 would be involved, including certain improvements in low service pumping.

Comparative Cost Estimates.—The comparisons were made for an average pumpage of 3,200,000 gal. per day and a hardness reduction from 190 ppm. to 60 ppm. with the results given in Table II:

As will be seen later the assumptions as to salt requirements and costs were conservative and in practice the salt costs have been materially less than estimated, and the cost per million gal. in 1927 was $27.20.

The zeolite plant made a still more favorable impression when the cost argument was reinforced by the saving of space; the avoidance of "mess and grief"; and the assurance of ease and "fool-proofness" of operation of the zeolite as compared to a lime-soda plant.

There remained one obstacle to a decision to proceed with zeolite softening in that there was no available precedent in large-scale municipal plants whose experience might be sought for guidance in this enterprise, nor was it definitely known how effective the zeolite material might prove in the removal of iron and manganese. The company therefore employed Robert Spurr Weston to study the chemical features and in conjunction with the plant chemist and bacteriologist, H. C. Kneeland comprehensive experiments were conducted on the boiler feed zeolite softener. In the meantime Henry Hass, the president of the Ohio Valley Water Co., investigated certain hotel installations on the Pacific coast, and their observations proving favorable, it was decided to proceed with a zeolite installation.

The Zeolite Installation.—The en-

Table II—Comparative Annual Cost Estimate for Lime-Soda vs. Zeolite Softening

Lime-Soda		Zeolite	
Labor and supervision	$ 6,000.00		$ 6,000.00
Lime, 242 tons @ $12	2,900.00		
Soda-ash, 550 tons @ $37	20,350.00	Salt, 2,200 tons @ $8.60	18,920.00
Alum, 60 tons @ $25	1,500.00	Wash water	1,970.00
Coke (for carbonizing) 180 tons @ $10	1,800.00		
Wash water	500.00	Additional pumping cost	3,030.00
	$33,050.00		$29,920.00
Fixed charges and maintenance	$10,000.00	Fixed charges and maintenance	$10,000.00
	$43,050.00		$39,920.00
Cost per millions gallons:			
Operating	$ 28.30	Operating	$ 25.60
Fixed	8.60	Fixed	8.60
	$ 36.90		$ 34.20

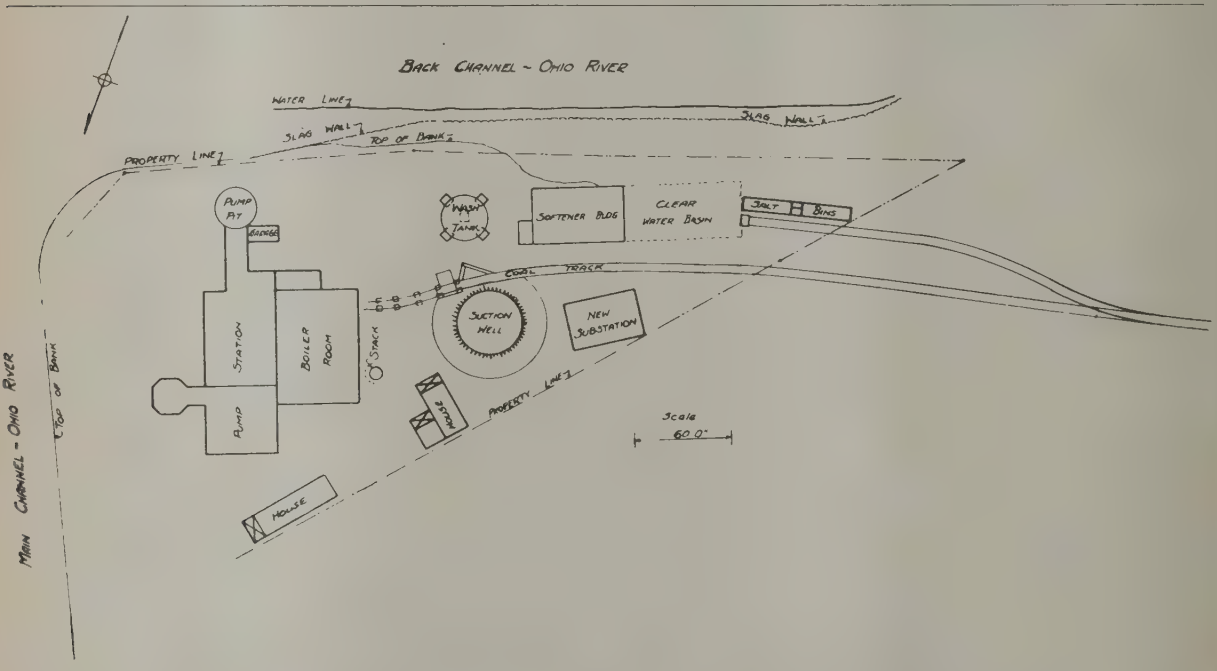
Table I

Chemical Analysis Made in 1923			Tabulation of Alkalinity and Hardness			
			Alkalinity		Total Hardness	
		Year	Min.	Max.	Min.	Max.
CO_2	10.0					
Fe and Al	6.3					
SiO_2	9.5	1920	53	96	121	212
$CaCO_3$	84.0	1921	89	106	178	218
$CaSO_4$	141.0	1922-23	71	97	142	254
$MgSO_4$	20.2	1926	....	....	200	250
HaCl	36.0	1927	....	....	209	293

closed steel-shell type of softener was chosen for this installation for the reason that more capacity could be installed in a given space than with open type beds, and space was at a decided premium at this plant. When the design was begin it was soon discovered that there was a deficiency in the information on some hydraulic and technical details, and consequently it became necessary to carry on some experiments on some smaller commercial units to determine this data. The head required to force the water through the bed, and the rate of flow through the bed under constant head conditions, were some of the questions requiring clarification.

While the pumps, delivering water from the wells through the softeners, would be capable of furnishing the requisite water for the washing of a single filter, yet there would be a serious curtailment in the softening rates of the remaining units unless the pumpage were supplemented from a storage reserve. It was therefore decided to install a wash tank which, besides furnishing wash water, also served several other useful functions, including that of an equalizer whereby the heads on the pumps were maintained nearly constant; (thereby insuring good efficiencies) and likewise delivery of the softeners (so far as affected by changes in head) sustained at a nearly uniform rate, which was but little effected even when water was being taken from the tank for washing and regenerating an exhausted filter.

Previous to the installation of the softening plant the water supply was pumped from the wells by horizontal low duty pumps located in two circular pump pits whose bottoms were at approximately river level and whose tops were above extreme high water. These pumps delivered the water into a covered rectangular concrete basin 130 ft. long by 35 ft. wide by 20 ft. deep whose flow line was ground level. This basin acted as a retention basin or clear water storage it being baffled by a center wall, extending the entire length of the basin to within 20 ft. of the end wall. The water entered on one side of this dividing wall, received its dosage of chlorine from Wallace & Tiernan liquid chlorine machines located alongside the basin and flowed the length of the basin, around the end of the baffle wall and back to a receiving chamber at the front end of the basin and from thence to a circular suction well 40 ft. in diameter from where it was picked up by the high service pumps and pumped into the distribution system.



Plan of Property and Buildings of the Ohio Valley Water Co., Neville Island (Bellevue) Pa.

It was decided to place the softening units on top of this retention basin, the roof and walls of which were reinforced to take the additional weight. The softening units consist of four steel pressure tanks 9 ft. in diameter and 22 ft. long set in a horizontal position and supported on a concrete slab set directly on top of the roof of the clear water retention basin. These units are housed in a brick building which also contains a salt solution storage tank and brine pump and a laboratory and office.

The Softening Units.—Each tank contains a 40 in. depth of zeolite sand underlaid with 18 in. of gravel, below which is located a pipe under-drain system for collecting the soft water and distributing the wash water. The wash water is carried off by means of a perforated pipe trough located 14 in. above the surface of the zeolite. Each unit has a sand area of 208 sq. ft. and operates at a rate up to 1,500,000 gal. per day, at the beginning of a run to 1,100,000 gal. per day at the end of the run. The valves on the filter piping are controlled hydraulically from an operating table located in front of the unit. The units are designed to permit a total loss of head of 14 lb., a portion of which is made up of negative head gained by carrying the soft water outlet pipe down into the clear well below the water line and trapping it.

A wash water tank having a capacity of 15,000 gal. is floated on the line between the low duty pumps and the softener units and acts in a two fold manner; first, to provide water for backwashing the units and second, to take up the differences in rate of softening due to the fact that while most of the time three units are operating and one is being regenerated, there are short periods when all four units are delivering water and since the pumpage is at a constant rate the tank supplies the excess water needed at this time. Orifice meters are provided on the inlets to the units and measure the rate of softening and also the rate of washing.

Salt Storage and Brine Distribution.—The salt storage and brine distribution are designed to give simplicity of operation. A salt charge of about 6 to 10 tons of salt is required per day which is shipped to the plant in box cars

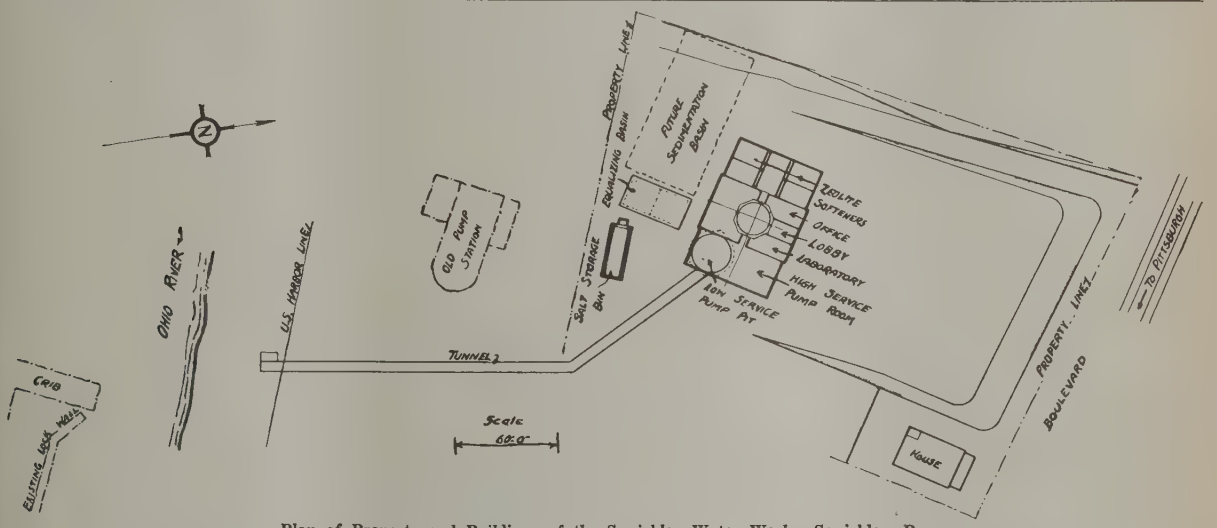
and shoveled from these cars into a double compartment concrete bin each compartment being 29 ft. long by 8 ft. wide by 13 ft. deep holding two weeks supply. The top is level with the ground and the bottom is hopper shaped and contains gravel graded from 3 in. to 1¼ in. underlaid with an open joint tile line. The salt is dumped into the bins and is covered with water, dissolving the salt and giving a saturated solution which is collected by the tile under-drain and carried to a solution well between the two salt compartments. This well is divided into two compartments in one of which is located a centrifugal pump for pumping the saturated brine solution up into the brine tank in the softening building from which tank it is pumped into the softener units as needed.

water. Since it had been the intention to deliver a final product to the consumers containing a hardness of about 70 parts per million, the softeners continue in operation about an hour longer, turning out hard water to mix with the soft so as to maintain the average product at about 70 ppm. All water is run through the filters in order that the manganese, iron and crenothrix may be removed, and to obtain such advantage of filtration as the passage of the water through the unit (regarded as a filter) would effect. The rate of flow through the unit is about twice the ordinary rate for rapid sand filters, and were the water contaminated, appreciable removals of bacteria might be expected. At Ohio Valley the final product is practically sterile before chlorination.

about five minutes, after which the drain valve is opened to waste, while the influent valve is "cracked" to allow "rinse" water to pass down through the bed at a rate of about 3 gal. per sq. ft. per minute for about 25 minutes, during which the chloride solutions are washed from the bed.

This regeneration period averages 30 to 40 minutes, and on completion the unit is held idle until an interval of about 5 hours has elapsed from the time when the softener was first put on the line. This 5 hour period represents the full "run" for a single unit, and as there are four units it will be seen that for a short time they are all delivering water, but that over much of the time one unit is being regenerated while the remaining 3 units are in operation.

The well water varies in hardness



Plan of Property and Buildings of the Sewickley Water Works, Sewickley, Pa.

Cost of Softening Units.—The cost of constructing the softening units complete together with all auxiliary equipment is as follows:

Wash Water Tank	$ 3,425.00
Salt Bins	8,712.34
Building and Foundations	11,046.63
Softener Units Complete with Zeolite	39,000.00
Piping, Valves, Meters, Operating Table, etc.	10,153.34
Pumps and Wiring	4,278.30
Railroad Siding	814.76
Labor—Other Than in Contracts	5,200.80
Miscellaneous	1,102.44
Engineering and Interest During Construction and Overhead	11,015.17
Total	$94,748.78

Operating Methods.—There were several alternatives open in the fixing of operating schedules and methods, but the plan finally adopted at the Ohio Valley Water Co. has proved quite simple and effective in practice. A unit, upon being started after regeneration, is given a "run" of about five hours. During approximately 3⅓ hours the unit turns out a water of zero hardness, and for a short period thereafter the water delivered varies uniformly from zero up to the full hardness of the well

At the end of this 4⅓ hour period, the unit is taken out of service and given a back-wash from the tank for 4 minutes at the rate of about 4.75 to 6 gal. per sq. ft. per minute. In the meantime a remote control push button has started the small brine pump at the salt storage tank outside the station, and has delivered a saturated brine solution to the small steel brine tank beside the softener units. The quantity delivered is measured to a nicety by hook gauges, and when the level of the upper hook gauge is reached the pump is stopped, and a second brine pump inside the station is started and pumps the measured brine solution into the exhausted unit through the perforated pipe manifold extending the length of the tank at the top.

The mixture of this saturated brine with the water above the sand gives about a 10 per cent solution. The drain valve is opened enough to pull this solution down into the sand, and the gate is then shut, allowing the solution to remain in contact with the zeolite

through the year, although the rate of change is quite slow and in operating practice it has been found advantageous to so fix the schedules that the period of operation or run for each tank is kept constant, and changes in hardness are met by varying the salt dose. In this way the variables are reduced to a minimum, and the operations can be subjected to a definite routine which do not overtax the abilities of ordinarily intelligent laborers under capable supervision. The problem of stopping at the end of the day is very simple since the entire plant is shut down, the softeners cut out of service, and the schedule picked up on the following day at the same relative point.

In the early operation the hardness of the well water was reduced gradually; a period of about two months elapsing between the reduction from about 180 to 54 ppm. This procedure was followed partly because it was thought that with the introduction of soft water, patches of the manganese deposits might break their moorings and leave by the route

of the house spigots, but experience has shown that these deposits are being gradually dissolved, and no complaints have been received because of "gobs" of blackness.

The plant during its 2½ years of operation has proved to be remarkably free from trouble and has been a model of "fool-proof" operation. Only two incidents have enlivened the steady routine. On one occasion a "gravel hill" developed in one unit which seemed to indicate a blown out strainer. This condition was quickly remedied without untoward results. On another occasion (about one year after the plant was built) the filter seemed to suddenly "plug up," and refused to pass the usual quantities of water. When a manhole was removed it was discovered that a well-matted growth of crenothrix had formed a blanket about ¾ of an inch in thickness over the top of the bed. This was removed to reveal what appeared to be virgin zeolite immediately below. Since that time inspections have been made monthly and once every month a longer period of washing has been given, with the result that no further difficulties have been experienced.

From all indications the zeolite can be used indefinitely, since the reversible reaction between sodium and calcium-magnesium does not tend to break down the zeolite grain or to decrease its base exchange capacity. The losses of sand due to abrasion seem to be low, since only 100 cu. ft. or approximately 3.7 per cent of sand has been added in two and one-half years (including the replacement occasioned by the removal of the the crenothrix mat with its embedded sand) or at the rate of 1.5 per cent per year.

Operating Features.—The salient operating features for this plant are incorporated in Table III.

The wash and rinse water has averaged about 10½ per cent of the output of the plant. In 1926 there were approximately 2,270 grains of hardness removed per cubic foot of zeolite with a salt dose of 0.328 lb. per 1,000 grains removal; while in 1927 the corresponding figures were 2,520 grains and 0.364 lb. respectively. For this plant and taking into account the costs of salt and wash water, it would appear that the most economical salt dose is in the neighborhood of 0.35 lb. per 1,000 grains of hardness removed.

The operating costs as set forth below are based on an expenditure of $95,000 with interest charged at 6 per cent, depreciation at 3 per cent, and maintenance at 1 per cent. The maintenance costs have been substantially nil to date, but it is thought only fair to make provisions for what is likely to occur at some time. The item for "Pumping Additional Head" represents the cost of lifting the water the additional height over that necessary under the former low lift conditions, as required to force the water through the closed softener units.

Tabulation of Annual Costs

	1926	1927
Labor and Supervision	$ 5,955.00	$ 6,409.00
Supplies and Expenses	278 00	199 00
Salt	11,362.00	14,667.00
Wash Water	637.00	540.00
Pumping Additional Head	2,482.00	2,162.00
Mineral	100.00	100 00
	$20,814.00	$24,077.00
Interest, Depreciation and Maintenance	9,500.00	9,500.00
Total	$30,314.00	$33,577.00
Per Million Gallons:		
Operation	$ 17.30	$ 19 24
Fixed Charges	7.90	7.56
Total	$ 25.20	$ 26.80

The original cost estimates were conservatively made on the basis of 0.5 lb. of salt per 1,000 grains removal, and $8.60 per ton salt cost, whereas the plant has been able to run on a 0.346 lb. and $6.475 per ton basis respectively, which represents a material saving.

The consumers have been enthusiastic about the soft water, particularly the housewives, since the job of laundering and cleaning has been made much easier. It has been difficult to obtain exact data as to the savings in soap, washing powder, etc., but from general inquiries and observations the savings approximate sixty per cent (by weight). The sale of soap powder and laundry soap has almost ceased. No difference in taste between the hard and soft waters has ever been reported, and the sodium salts remaining in the water do not offer any objections in domestic or commercial use.

The Sewickley, Pa., Installation.—A similar problem developed at Sewickley, Pa., in 1927, and in making comparisons between lime-soda and zeolite softening there was available the detailed operating data on a modern lime-soda plant as designed by this firm for Greenville, O., as well as the zeolite plant at the Ohio Valley Water Co. The Greenville plant was equipped with mechanical mixing tank, Dorr Clarifier and carbonizing equipment, and was operating on the excess-lime principle, effecting excellent reductions in hardness on a favorable cost basis.

Sewickley is a community of about 5,000 people situated on the Ohio River about twelve miles below Pittsburgh. Its supply is a ground water, derived from a crib sunk into the gravel bed of the river, and is clear and substantially pure at all times. Chemical analyses taken at intervals over several years show variations in alkalinity from 80 to 100 and in total hardness from 170 to 215, and an analysis of a sample taken April 25, 1927, is as follows:

Calcium carbonate	118
Magnesium carbonate	7
Calcium sulphate	56
Magnesium sulphate	15
Sodium sulphate	37
Oxide of iron and alumina	0.8
Sodium chloride	27

The crib water is of such excellent quality from a sanitary standpoint that it was decided to continue it in use, but as there was a remote possibility that an accident might damage the crib and permit contamination from the river; and also that at some future date the river might be used as a source of supply, it appeared advisable to design the units so that they might be employed as filters if necessary.

Comparative Costs.—A comparison of the cost of a lime-soda softening plant with a zeolite plant, each of two million gallons per day capacity, but to operate on a twelve hour schedule and to deliver 1,000,000 gal. per day average, and 130 ppm. is set forth in Table IV:

The comparison was so clearly in favor of the zeolite softener as to indicate its adoption, and plans were

Table III—Operation of Softening Plant of Ohio Valley Water Company, Bellevue, Pa.

Month	Gallons Water Treated	Gallons Wash Water	Average Hardness in ppm. Untreated	Before	After	Pounds Salt Used	Average Pounds of Salt Per Thousand Grains Hardness Removed	Cost of Salt Per Ton	Cost of Salt Per Million Gallons
Nov., 1925	91,930,980	9,180,000	160.0	53.83		334,250	0.494	$6.60	$12 00
Dec., 1925	92,477,085	9,440,000	193.4	86.37		240,000	0.350	6.60	8.56
Jan., 1926	94,529,465	11,500,000	219.5	81.12		237,200	0.319	6.60	6.28
Feb., 1926	87,236,600	11,580,000	202.7	66.37		224,625	0.324	6.60	8.52
Mar., 1926	97,479,975	10,200,000	204.0	68.74		240,926	0.312	6.60	6.16
Apr., 1926	91,442,725	9,450,000	196.9	68.6		218,106	0.319	6.60	7.87
May, 1926	100,549,900	10,720,000	198.2	69.11		244,452	0.336	6.60	8.02
June, 1926	95,492,005	10,000,000	234.4	74.77		286,477	0.325	6.60	9.90
July, 1926	109,780,680	11,260,000	248.7	64.14		390,990	0.331	6.60	11.79
Aug., 1926	111,251,460	11,080,000	246.0	68.68		395,050	0.341	6.60	11.30
Sept., 1926	107,040,300	10,800,000	234.0	65.74		329,450	0.312	6.60	9.77
Oct., 1926	109,962,405	10,740,000	241.0	71.		332,325	0.303	6.60	9.60
Nov., 1926	98,167,680	9,820,000	237.0	68.6		294,600	0.317	6.60	9.52
Dec., 1926	100,263,855	10,380,000	233.0	64.		310,800	0.315	6.60	9.84
Total	1,203,190,000	127,540,000	2695.4	830.77		3,505,000			
Average	100,266,000	10,628,000	224.6	69.23		292,900	0.328		
Jan., 1927	104,627,720	10,300,000	216.0	63.0		311.150	0.342	$6.35	$ 9.43
Feb., 1927	92,492,855	9,570,000	211.0	62.3		265,175	0.331	6.35	9.10
Mar., 1927	101,713,175	10,832,000	209.2	63.0		289,300	0.337	6.25	9.03
Apr., 1927	100,698,100	11,010,000	210.4	67.0		293,695	0.349	6.35	9.26
May, 1927	104,273,140	11,172,000	216.5	67.2		297,000	0.328	6.35	9.04
June 1927	106,898,560	11,054,000	233.0	68.9		322,675	0.325	6.35	9.89
July, 1927	119,625,821	10,850,000	284.0	87.0		512,425	0.373	6.35	13.60
Aug., 1927	109,543,082	12,030,214	266.0	95.0		508,200	0.470	6.35	14.73
Sept., 1927	105,672,324	11,770,000	253.8	77.0		428,800	0.369	6.35	12.86
Oct., 1927	105,513,040	11,572,000	293.0	82.0		492,150	0.407	6.35	14.81
Nov., 1927	98,579,698	10,626,006	284.0	70.5		462,200	0.376	6.35	14 89
Dec., 1927	101,621,880	10,245,645	251.0	68.0		393,450	0.364	6.35	13.34
Total	1,251,514,000	131,030,000	2927.0	872.9		4,558,000			
Average	104,293,000	10,920,000	244.0	72.7		379,800	0.364		

Table IV—Comparative Cost Estimates for Two Million Gallon Per Day Softening Plant

	Lime-Soda		Zeolite
First Cost (softening plant only)	$88,000.00		$65,000.00
Fixed Charges	7,040.00		5,200.00
Labor	3,600.00		3,600.00
Maintenance, etc	600.00		600.00
Lime, 122 tons @ $14	1,708.00	Salt, 550 tons @ $6.50	3,575.00
Soda-Ash, 122 tons @ $34	4,148.00		
Alum, 20 tons @ $25	500.00	Additional wash water	105.00
Coke, 55 tons @ $12	660.00		
	$18,256.00		$13,080.00
Average cost per million gallons:			$ 21.65
Operating	$ 30.80		14.15
Fixed	19.20		
Total	$ 50.00		$ 35.80

drawn on the basis of the open, rapid sand filters employing zeolite sand as the softening medium. The status of the patent situation on zeolites was in a highly unsettled state at this time, in fact some of the important court decisions, plant consolidations and company understandings were announced between the time the plans were started and the letting of contracts. In order to secure competition alternate plans were designed to that definite competitive bids could be obtained on (a) downward softening, (b) upward softening, employing green sand (glauconite) or synthetic zeolite in either case. Bids were received on each scheme. The finally accepted bid called for three beds of green sand for downward softening, and one bed of ordinary quartz filter sand for supplying wash water and filtered hard water for mixing with the zeolite-softened product, in order that the water, as delivered to the consumers, might have a hardness of about 60 ppm.

The Water Supply.—Water is drawn from the crib, buried in the gravel formation below the bed of the Ohio River 75 ft. from shore, through an 18-in. cast iron suction pipe carried in a concrete box culvert 4 ft. 3 in. wide by 5 ft. high with bottom approximately at pool level. This culvert or tunnel terminates in a circular concrete well 23 ft. in internal diameter by 40 ft. 6 in. deep, the bottom being approximately at pool level and the top on the level of main pump room floor. This pit contains two 1,400 g.p.m. low duty motor driven centrifugal pumps, with space reserved for a future third pump. These low duty pumps deliver into a concrete equalizing basin in the rear of the plant having a capacity of 40 minutes for a 2,000,000 gal. per day rate and divided into two units so designed that if in the future it should become necessary to abandon the crib and use raw river water these basins could be converted into mechanical mixing chambers for receiving coagulants and a sedimentation basin could be built in the space reserved for same alongside this equalizing basin. From the equalizing basin the water will pass directly into the softening and filtering plant consisting of four units of 182 sq. ft. each or a total capacity of 2,000,000 gal. per 24 hours based on a rate of 2 gal. per square foot per minute. These units are of the standard rapid sand type having steel wash water troughs whose top edges are located 30 in. above the top of the sand and 30 in. of sand laid on 18 in. of gravel graded from ¼ in. up to 3 in. in diameter. This gravel rests on a concrete bottom under which is a false bottom having an open space of 20 in. for admitting wash water and equalizing its distribution. The top of this false bottom contains ⅜-in. brass strainer nipples 6 in. on centers, into the top of which are screwed umbrella type brass strainers, so designed that the loss in pressure when washing at a rate of 15 gal. per square foot per minute will not exceed 2 ft.

The sand in three of these units consists of green zeolite sand having an effective size of 30 mm. and that in the fourth unit is quartz sand having an effective size of 40 mm. Water will pass downward through all four filters at the rate of 2 gal. per square foot per minute, being filtered in its downward course through all four filters and in addition being softened to zero hardness in the three zeolite sand filters. The rate of filtration is controlled by means of rate controllers located in the outlet pipe from each filter, the three softening filters delivering into a soft water clear well located under two of the filter units and the main floor lobby on one side of the pipe gallery and the fourth filter delivering filtered but hard water into a hard water clear well located under the other two filters on the opposite side of the pipe gallery. These two clear water wells or basins are connected into a third well or high service suction well located under the other half of the lobby floor. By this arrangement there is approximately three times as much soft water as hard water admitted into the high service suction well so that the mixed water pumped into the reservoirs through a rising main by the high service pumps has a hardness of about 50 to 60 parts per million.

All four filters will be washed upward at a rate not exceeding 15 gal. per square foot per minute, with wash water taken from the hard water clear well by means of a wash pump located on the high service pump room floor.

The three zeolite sand filters are regenerated by means of a brine solution pumped from a brine polution tank in the pump room basement by means of a motor driven centrifugal pump and delivered on the top of the zeolite sand through orifices in the pipe lines located directly under the wash troughs.

This brine tank in the pump station basement receives saturated brine solution from concrete brine bins located outside the building adjacent the equalizing basin and constructed similar to the brine storage bins previously installed for the Ohio Valley Water Co. softening plant.

Two high service motor driven centrifugal pumps each having a capacity of 1,300 gal. per minute and located on the main pump room floor will take their supply from the mixed water suction well and will deliver it through a 10 and 12-in. cast iron main to a series of reservoirs located on a hill above the town from whence it will flow by gravity into the distribution system.

The operation of the plant has been simplified as far as practical, hydraulic operating valves being furnished for each filter unit, with loss of head and rate of flow gauges on each operating table. An indicating wash water and brine gauge has been provided so that the exact rate of washing and feeding of brine solution can be told by a glance at the gauge. A vacuum pump has been provided for priming the pumps, and also a clear well gauge and a high and low water alarm connected to the clear well.

In as much as the plant must be capable of handling contaminating river water which might by accident get into the crib or low duty suction main through a break, a dry feed machine and a chemical storage floor have been provided so that alum can be mixed with the raw water before it enters the equalizing basin and thus form a mat on the surface of the filter sand.

Two Wallace & Tierman liquid chlorine machines of the vacuum pedestal type have been provided for sterilizing the water in the clear water wells.

This plant is now under construction, the substructure having been ready for the brick work at the time of writing this paper.

The contract prices are as follows:

Substructure	$ 59,343
Superstructure	53,500
Filter Equipment	22,490
Filter and Softening Material	10,650
Pumps and Wiring	12,676
Total	$158,659

It is anticipated that the units will each deliver "zero" water for a period of approximately 4½ hours, at the rate of about 2 gal. per square foot per minute, maintained uniformly by the rate controller. The unit will continue in service about two hours longer, during the early part of which the water will pass from zero to full hardness, and during the latter part a completely hard water will be delivered. The remaining water required to produce a water of 60 ppm. hardness will come from the quartz sand filter. The normal period of regeneration should be about ½ hour,

making the total "run" of a unit about 7 hours.

The two cases here presented relate to water which are initially clear and relatively pure and which have a fairly high percentage of permanent hardness; an ideal situation for a zeolite plant. In such cases the plant cost can be kept lower than with the lime-soda process since the cost of brine storage will be less than storage for lime, soda ash, etc., and the mixing chambers, clarifiers, sedimentation basins, and carbonating apparatus, which are vital elements in a modern lime-soda plant can be largely eliminated from a zeolite plant. These savings will be considerably greater than the cost of zeolite compared to quartz sand.

The Sewickley softening units are designed like rapid sand filter units, but with green sand or zeolite substituted for quartz sand. Provisions are made for the introduction of alum to form a "schmutz decke" on top of the sand if necessary in affecting purification. Since a high rate of wash (15 gal. per square foot per minute) is provided, these units may be thoroughly cleaned and the full softening capacity of the sand maintained. The units will be delivering water for less than 7 hours per run between regenerations, or a period during which the loss of head will be comparatively low, insuring against negative heads and the release of air in the filters, which air would prevent obtaining the full exchange capacity of the sand by keeping the water away from that part of the sand which is air-bound.

Under these conditions small amounts of sediment in the water reaching the softeners could be handled, but in the case of muddy waters, sedimentation basins or roughing filters would need to be interposed ahead of the softeners. In one case recently considered, such a combination indicated economics as compared to the lime-soda process.

A combination of the lime-soda and the zeolite process might prove advantageous under certain circumstances, especially where muddy waters and those high in temporary hardness were encountered. Lime could be employed to bring down much of the temporary hardness and after carbonating the water, it could be carried to a zeolite softener where it could be reduced to "zero" hardness if necessary, or stopped at any predetermined point between.

The results in full-scale operation have been so successful as to warrant the belief that the zeolite process of softening may be found advantageous in the solution of many municipal softening problems. The simplicity of the regenerating process; the case with which it lends itself to definite operating schedules; the assurance of control over the final product; freedom from after-deposits as sometimes occur with the lime-soda process; the absence of dust and handling problems incident to lime-soda plants, and the factor of economical operation are features which make the zeolite process attractive and worthy of consideration where conditions are favorable.

Acknowledgment.—The foregoing is an abstract of a paper presented at the 1928 convention of the American Water Works Association.

Paving Brick Association Appoints Q. A. Campbell Secretary

Quincy A. Campbell has been appointed acting secretary and assistant to the managing director of the National Paving Brick Manufacturers' Association.

Q. A. Campbell

Mr. Campbell was born in Bellefontaine, O., in 1891, and entered the Civil Engineering course at Ohio State University, completing three years of the course before enlisting in the military service in the summer of 1917. During the World War he served as instructor in the Aviation Ground school at Ohio State University and at Kelly Field, Texas. After receiving his discharge from the Army in 1919, he became assistant engineer for the city of Hamilton, O., returning to Ohio State University that fall and received the degree of Bachelor of Civil Engineering in 1920.

After graduation he spent the next year in engineering work in the Republic of Santo Domingo. Returning from there in the summer of 1921, he entered the Ohio Department of Highways as an Assistant Engineer, being later appointed Assistant Division Engineer and serving in that capacity at Ravenna, O., for five years. In 1927 he was promoted to the position of Assistant Chief Engineer of Maintenance, with headquarters at the Columbus office of the Ohio State Highway Department, which position he has resigned to enter his present employment.

George F. Schleisinger, who until recently was director of highways for the state of Ohio, assumed his duties as chief engineer and managing director for the National Paving Brick Association on July 1, 1928.

Forest-Program Committee Proposes 10-year Plan

Representing various local interests and the Massachusetts Forestry Association, a committee of eight has drawn up a 10-year plan for the protection and rehabilitation of the forests of Worcester County, Massachusetts. The committee recommends that the county be divided into four districts of about 150,000 acres each and that a woodland owners' and a forest wardens' association be formed in each of these districts. These associations would be in a position to employ foresters and cooperate effectively in carrying out forest protection, forest management, and forest-utilization plans.

Other recommendations include the extension of State forests to cover 10 per cent of the forest land of the county, consolidation of public forest lands, acquisition by the State of lands in districts where private owners may be slow to apply forest management because of the fire hazard, more educational work with schools and other organizations and by preventive patrol, the installation of adequate fire-fighting equipment, including power pumps and of permanent fire-protection crews on State forests, the erection of two additional observation towers in the county, the acquisition by each town of fire-fighting equipment to include at least 12 extinguishers or hand pumps, 12 shovels, 12 wire brooms, and a conveyance for transporting men and equipment, and the hiring of a patrolman by each town during dangerous fire seasons.

The county contains 970,000 acres of land, of which about 630,000 acres is in forest or brush pasture. The committee estimates that there are about 350,000 acres in the county better adapted for forest production than for any other crop. At present the county has 127 factories engaged in making products, of which wood is the chief material. The greater part of this wood and over 80 per cent of the lumber used in building is imported from the South and the Pacific coast. The rehabilitation of the forests of the county, therefore, bids fair to be a paying enterprise on more than one count.

Two Unusual Types of Pavement

Cement Macadam and Sodium Silicate Surface

MACADAM With Quick Hardening, Cement Binder.—This pavement known in France as cement macadam. It somewhat resembles a pavement constructed sometimes in the United States as Hassam pavement. The cement macadam surface consists of a layer of crushed stone of 3 in. to 2½ in. thick after rolling, which is filled with a mixture of lumnite cement and screenings. The screenings are mixed to a slightly damp consistency and swept and rolled into the road as would be done in ordinary waterbound work. Rolling is carried on exactly as in waterbound macadam and sufficient water used to harden the cement. The surface is a compacted thickness of about ¾ in.

One sack of cement is used for each 13 sq. yd. of cement macadam surface. After completion the road surface receives a treatment of approximately 2 qt. of emulsified asphalt or tar with stone chips sufficient to cover.

Figure 1 shows filler being mixed with cement in cement macadam construction. Fig. 2 shows a cement macadam base rock filled with cement screenings. Due to quick hardening of high alumina cement this type of surface may be used within a day after its construction.

Sodium Silicate Pavement.—Figure 3 shows a sodium silicate street surface in Brives, France. This unusual type of construction has found some favor in France, where traffic is light and where funds are not available for more expensive road work. It is essential that the stone consist of a pure limestone and that it be free from appreciable amounts of siliceous matter. In practice it is usual to take the stone out one year before use in order to entirely free it from any clay or dirt which might stick to the stone. The same result would probably be accomplished by thorough washing. Stone for the first course is from 1½ in. to 2½ in. in size. Fines and filler from the same stone, including dust, is mixed with 58° Be. sodium silicate in proportions of about 10 gal. to each cubic yard of fine material. The mixing may be accomplished in a concrete mixer. The mortar produced is spread over the coarse stone with a shovel. The coarse stone and mortar is then mixed on the road, using forks, and this is followed by steam rolling with a roller weighing about 12 tons. In some cases the coarse stone and fine material are mixed with sodium silicate in a concrete mixer. During the rolling operations the sodium silicate and limestone mixture comes to the surface in yellow patches. Rolling is continued until this color becomes uniform and until it is a paste or batter over the surface. When this condition is reached the road is considered as complete.

Acknowledgment.—We are indebted to C. L. McKesson, Materials and Research Engineer, California Division of Highways, for the information and photographs used in this article.

Fig. 1—Cement Macadam Construction—Mixing the Filler With Cement

Fig. 2—Cement Macadam Base Rock Filled With Cement and Screenings

Fig. 3—Sodium Silicate Street Surface in Brives, France

Cleaning Sewers By Flushing

Notes on English Practice

By F. JOHNSTONE TAYLOR

IN flat districts the engineer concerned with sewerage work is confronted with a relatively difficult problem. Good sewerage from a sanitary point of view demands that sewers shall have a self-cleansing velocity. On the other hand, present day practice requires as a rule that they shall have a capacity of at least six times the dry weather flow, and, in addition, provision must be made for increased volumes of sewerage at a later date. The result is that in many instances it is necessary to put in sewers which, for some years after their completion at any rate, will not satisfy hydraulic considerations in respect of a self-cleaning velocity on account of the limited fall available. To some extent this difficulty can be overcome by the use of oval sewers which have a relatively large depth of water on the invert in relation to small flows, but this class of sewer is only practicable for fairly large mains and it is moreover costly to construct. A large amount of average sewerage work can be carried out by means of pipes, either of fireclay, stoneware or concrete as may be deemed desirable, and if at normal flows they become sluggish resort must be had to flushing. At the same time sewer flushing requires to be judiciously carried out because the necessary apparatus adds to the cost and in practice is not always as effective as it might be.

Sewer Flow.—A study of sewer flow has revealed that the solid matter in sewage is carried either by dragging, intermittent suspension or continuous suspension. In respect of dragging the following velocities are necessary in order to commence motion of the materials named:

Material	Velocity in ft./sec.
Fine sand	0.50
Coarse sand	0.75
Road detritus	0.80
¼-in. gravel	1.00
½-in. gravel	1.25
1-in. gravel	1.80
1½-in. gravel	2.25
2-in. broken stone	3.30
2½-in. broken stone	3.80

The material will be found to always move with a velocity of less than the stream, the mean velocity of the material being about 0.60 of that of the stream. Depth of flow is a very important factor in determining the motion by dragging. Broken stone, for stance, of 2½ in. gauge which is listed above will only just move at the velocity mentioned in 1 in. of water, but with a depth of 6 in. motion is quite easy when the velocity is but 2 ft./sec. In other words, the transporting power of the liquid in a sewer varies with its depth. The water wave on striking a particle is deflected from its rounded surface, and this resistance to deflection does greater work on the particle if the stream is deep than if it is shallow. In a deep stream the water strikes the particle under greater pressure due to the greater head and its translational energy is greater although the bottom velocity is not dependent on the depth of flow to as great an extent as is surface velocity.

Of considerable trouble in sewers is road detritus. This certainly only reaches the sewers in time of storm, when there should be sufficient velocity to carry it off to the outfall. But heavy road detritus requires a mean velocity of 2½ ft./sec. and 4 in. depth of flow to clear it away and quite an appreciable amount is left in the sewers after the storm has subsided if these conditions are not realised by normal flows.

Motion by Suspension.—If one purposely puts solid matter in a sewer—fine material, for instance—it will be found that though motion is commenced by dragging, the particles are more or less rapidly lifted up into the stream and motion is carried on by suspension. The greater amount of material is carried in the lower layers of the stream, the amount being proportional to the depth. Motion, too, is seen to be from the sides towards the centre, the majority of the suspended matter being carried along the center of the stream. The amount or the size of the matter carried in suspension depends upon the velocity of the stream and its depth of flow and to a greater extent upon the latter, because in a deep stream the particles are thrown to a greater height than in a shallow one and as the velocity of descent of the particles is the same in both cases, the deep stream carries the particles further owing to their greater opportunity of remaining suspended.

Failure, therefore, to deal with the solid matter is in pipe sewers, at any rate, due to insufficient depth of flow rather than velocity, and especially is this condition evident in lateral sewers which only receive intermittent discharges from the dwellings connected to them. Thus deposits are formed which require periodical removal by flushing. If such deposits are not removed a filmy growth appears on the pipe wall. This growth in turn reduces the velocity and so matters go from bad to worse, with the additional evil of the production of large volumes of sewer gas and over septicising of the sewage which adds to the difficulties of treatment. In general it is advisable to provide means for flushing pipe

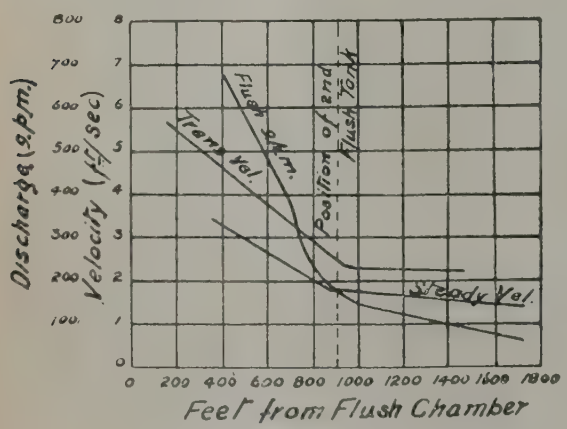


Fig. 1.

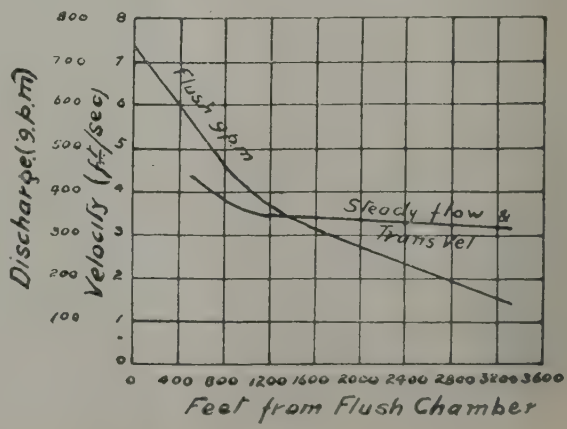

Discharge (g.p.m.)
Velocity (ft./sec)
Flush g.p.m.
Steady flow & Trans Vel
0 400 800 1200 1600 2000 2400 2800 3200 3600
Feet from Flush Chamber

Fig. 2.

sewers when the gradients are flatter than those indicated below.

12 in. diameter	1-200	21 in. diameter	1-500
15 in. diameter	1-300	24 in. diameter	1-600
18 in. diameter	1-400	27 in. diameter	1-750

Effects of Flushing.—It is not necessary to describe here the usual arrangement of flushing chamber beyond stating that it should be designed to discharge the water at a high velocity 1,000-1,500 gal. per minute by means of a syphon. It is not necesary to use in the aggregate a very large amount of water, as flushing need not as a rule be done at intervals of less than 12-24 hours, but when the flush does come down it should all but fill the sewer. The depth of flushing wave decreases from the flush tank end to a point downstream at which the depth and velocity are but little affected by the discharge. Take, for instance, a 12-in. sewer, and assume a 1,500-gal. tank discharging in 1¼ min. through a 10-in. syphon. With a gradient of 1-630 the condition of affairs is indicated by the diagram in Fig. 1. On this diagram are shown two curves designated as the curve of transmission velocity and the curve of steady flow velocity. In respect of the first named the rate of transmission at the commencement of the flush and at different distances from the flushing chamber is that which would give the maximum scouring velocity if the flush were discharged into an empty sewer. This velocity lasts but a few seconds, and its effect reaches but a short distance. In respect of the steady flow velocity during the period when the maximum quantity of flushing water is passing at different distances from the flushing chamber, it will be seen that this velocity lasted for a minimum period of 1 min., the time increasing with the distance from the flushing chamber. There is also a curve showing the maximum quantity of flushing water in gal. per min. at different distances from the flush chamber. From this curve the effect of varying the amount of flush water discharged per min. can be determined. As a comparison one may refer to Fig. 2, given by the same authority in respect of a 9-in. sewer with a flush of 750 gal. for one minute. Examination of these curves reveals the fact that:

(1) The velocity dies off rapidly at first until it attains a certain value after which the diminution is small. In consequence the flush is transmitted over quite long distances, possibly up to one mile.

(2) With flat gradients, the velocity when the maximum quantity of flush water is passing is less than the rate of transmission at the commencement of the flush, the difference gradually decreasing as the gradient decreases, until as indicated in Fig. 2 the velocities are identical. It would appear therefore that the slope of the advancing flush will gradually flatten as the distance from the flushing chamber increases except where the gradient is such as to secure a high velocity. It is noticeable also how the steady flow velocity is over 3 ft./sec, at a distance of more than 3,400 ft. from the flush chamber. If, therefore, the sewer gradient is reasonably good, though less than the minimum value previously advised, and a good flush is rapidly discharged, the sewer can be kept clean for at least half a mile even though its capacity is considerably in excess of normal flow.

Referring again to Fig. 1, which may be further analysed, on the flush being discharged into a manhole from which the upper portion of the sewer was cut off by a flap valve, the water rose 27 in. in the manhole and the hydraulic gradient for the first 360 ft. is increased from 1-630 to 1-120. At 900 ft. where it will be noted another flushing chamber is placed, the steady flow velocity is 1.9 ft./sec., and the transmission velocity 2.5 ft./sec. The influence of the flush was found to produce a good scour up to 1,200 ft. when the steady flow velocity was only 1.7 ft./sec. with a transmission velocity of 2.4 ft./sec.

Acknowledgment.—The above article is reprinted from the Commonwealth Engineer.

Portable Scraper Outfit Cleans Debris from New Sewer

A portable scraper power unit was used by the Northern States Contracting Co. for removing debris from a newly completed sewer at St. Paul, Minn. The sewer, of 12-ft. horseshoe shape, was 4 miles in length.

In order to get the power unit down into the sewer, it was necessary to remove the drums and the motor and reassemble the unit after it was inside. The power unit was set up near a manhole and by operating the "Screscent" scraper on a 300-ft. drag, all the muck and debris between two manholes could be cleaned out at one set-up; then the equipment would be moved on to the next manhole. Three laborers were used in the sewer; one to run the power unit and two to handle shovels. As fast as the material was piled up under the manhole by the scraper, the shovelmen loaded the material into buckets, which were hoisted to the surface with hand winches.

Removing Debris from a 4-Mile Sewer with a Sauerman Portable Scraper Unit

Locating Leaks With an Aquaphone

The following useful suggestions on locating leaks with the aquaphone was given by E. O. Sweet, Chief Engineer, Birmingham Water Works Co., Birmingham, Ala., in a paper presented at the recent convention of the Southeastern Water and Light Association.

If you send a man out to locate leaks with an aquaphone, make him take along a hydrant wrench and a curb stop key. Insist that if he hears a leak on a service that he close the curb stop and listen again. If he does not hear it then, the leak is beyond the meter, and he should stop long enough to ascertain if the meter is catching the leak. If he hears a leak on several services in the block, make him stop long enough to find on which service it sounds loudest. This is the point nearest the leak and it will save time for the repair men to have this knowledge. Another inexpensive and quick way of finding leaks in our larger cities is to send men through the large trunk storm sewers. Many leaks have we found by so doing. Another quick method is to look into all telephone company duct manholes. Water will often be found entering their ducts and flowing to a manhole.

One Hundred Per Cent Payment of Water Bills at Bangor, Me.—The 1927 reports of the Water Board of Bangor, Me., contains the following interesting item: "We can again report that the payment of water rates has been 100 per cent, indicating the success of the balanced method used in the collection department. It has been necessary to shut off only one service for non-payment of water rates. With an estimated yearly turn over of some 30,000 accounts, this reflects exceptional credit to the water takers."

Detroit Now Has Best Lighted Street in the World

On July 10, the new 5-light ornamental illumination system on Washington Blvd., Detroit, Mich., was officially placed in service, making the boulevard with its tall buildings on either side a veritable canyon of artificial sunshine

The lighting standards, placed in double rows along the parkway in the middle of the street, are unique in many respects According to illuminating engineers of the General Electric Company, who designed the system, they are the most distinctive used anywhere in the country. The illumination per pole, 10,500 candlepower, exceeds State Street, Chicago, heretofore America's best lighted street, by more than 1,000 candlepower. The glassware used to house the lamps is also of record-breaking size. This is also the first installation having large Mazda lamps in groups of five to a standard.

The trustees of the Book Estate, visualizing some years ago the development of this wide boulevard into one of the finest retail shopping centers, included in their plans a most comprehensive scheme of lighting—one that would place the boulevard among the finest, lightest streets in America.

These tentative lighting plans were turned over to W. D. A. Ryan, director of the illuminating engineering laboratory of the General Electric Co. at Schenectady, who with his technical laboratory staff worked out the engineering plans and with J. W. Gosling of the laboratory, the art work in connection with the standards and globes.

The engineers made numerous tests and surveys, and adopted a plan of location and spacing of standards which, coupled with the size and design of the lamps, gives maximum diffusion and distribution of light.

Each standard has five specially designed Novalux units, 24 by 36 in. in size, each equipped with a 1,500-candlepower incandescent lamp, mounted on King ornamental standards 32 ft. in height. The equipment will furnish more than 2,000 lumens per lineal foot of street frontage. This is 20 times as much light as previously used on Washington Boulevard.

The glass globes are designed with a scheme of corrugation that refracts the upward rays, directing them laterally and thus conserving light that is usually wasted.

The city lighting commission previously served Washington Boulevard with as much light as other downtown streets, but on account of the unusual width of the boulevard it was considered inadequate.

All five lamps on each standard are to be lighted every night until 1 o'clock; the uppermost light will remain in service until morning.

Institute of Municipal Administration to Be Held at University of Southern California

6-Day Course of Lectures and Round Table Discussion

AN Institute of Municipal Administration is to be held at the University of Southern California, Los Angeles, Aug. 13th to 18th, according to announcement of President R. B. vonKleinSmid. It will be attended by mayors, managers, commissioners, city and county officers, and citizens actively interested in public affairs.

Covering a scientific and practical study of modern municipal administration, the August Institute will include an intensive 6-day course of lectures and round table discussions on city planning, municipal finance, street traffic control, public health, municipal engineering, social welfare, legal problems of municipalities, public institution, recreation, and park administration, city clerkship administration, councilmanic problems, and county administration.

Lectures by Nationally Known Authorities.—Sessions, to be held mornings and afternoons on the S. C. campus with public lectures in the evenings, will be headed by experts in municipal affairs from cities throughout the country. Nationally known authorities who are to lecture include the following:

William B. Munro of Harvard University, vice-president of the National Municipal League, who is to discuss a Survey of the Organization and Forms of Municipal Government.

John Edy, City Manager of Berkeley, Cal., and President of the International Association of City Managers.

C. M. Spofford, Chairman of the Department of Civil Engineering at Massachusetts Institute of Technology, and a specialist on bridge construction.

Harland Bartholomew of St. Louis, city planner for forty municipalities, a member of the Board of Governors of the American Institute of City Planning, and Director of the City Planning Division of the American Society of Civil Engineers.

Miller McClintock, Director of the Erskine Bureau of Street Traffic Research at Harvard University, vice-president of the National Safety Council, and consultant of the San Francisco Survey Committee, the Chicago Association of Commerce, the Los Angeles Traffic Commission, and to the cities of Boston, New Orleans, Providence and Knoxville.

Francis Hiller of New York City, Field Representative of the National Probation Association, and a member of the Juvenile Dependency and Delinquency Section of the Institute.

Edwin A. Cottrell, Professor of Political Science at Stanford University, who is to head sessions on General Principles of Government.

Abel Wolman, Chief Engineer of the State Department of Health, Baltimore, Md., to head the section on Sanitary Engineering.

Ira V. Hiscock of Yale University, Bacteriologist of the Connecticut State Department of Health, and Commissioner of the Board of Health of the City of New Haven, Conn., who is to be special lecturer on Public Health at the Institute.

Otto Schreiber, head of the Institute on Air Law at the University of Koenigsberg, Germany, who is to head sessions on Air Law.

Other experts will head sessions on municipal budgets, city clerkship administration, city and county attorney's problems, and civil service.

Faculty members of the University of Southern California on the Special Committee which formulated the courses and cooperated with the technical committees in arranging the program include Emery E. Olson, Director of the Institute; Dr. Justin Miller, Dean of the S. C. School of Law; Dr. Earle F. Young of the School of Social Welfare; Professor Roy T. Malcolm of the Department of Political Science; Professor T. T. Eyre of the College of Engineering; Professor T. H. Ross of the College of Commerce; Professor William R. LaPorte of the Department of Physical Education; Professor O. R. Hull of the School of Education; and Dr. Julio Endleman of the College of Dentistry.

Indicating the widespread interest among the lay public whose influence is of increasing importance in public affairs, an advisory board of citizens not in public office include prominent men and women from San Francisco; Helena, Montana; Fresno, Cal.; Idaho; Ventura, Cal.; West Texas; Pasadena, Cal.; Jerome, Ariz.; Alhambra, Cal.; Oakland, Cal.; Phoenix, Ariz.; Stanford University; and Inglewood, El Segundo, Monrovia, Fullerton, Bakersfield, Glendale, and Los Angeles, Cal.

The Institute membership will cover Arizona, Utah, Nevada, Idaho, Colorado, New Mexico, Texas, Montana, Wyoming, Washington, Oregon, and California, according to Mr. Olson, the Director, who states that registrations are already being received to indicate that hundreds of students will attend the one-week school of city and county affairs.

Technical committees of public officers who have cooperated with the University of Southern California in creating the curriculum include the Association of City Planners, with Charles H. Diggs of the Regional Planning Commission as Chairman; the City and County Engineers Association, with W. K. Knowlton, City Sanitation Engineer, Los Angeles, as Chairman; the Treasurers, Auditors and Assessors Association, with George H. Wood, Auditor, Pasadena, as Chairman; the Association of City Clerks with Victor McCarthy, City Clerk of El Segundo, as Chairman; the City and County Attorneys Association, with Jess Stephens, City Attorney of Los Angeles, as Chairman; and the Juvenile Dependency and Delinquency Section, with Mrs. C. Raymond Bradford as executive secretary, and Judge Robert H. Scott of the Juvenile Court of Los Angeles as Chairman.

Civic, professional and business leaders, chambers of commerce, the California League of Municipalities, the California Real Estate Association, and the Health Officers Association have endorsed and sponsored the Institute by their hearty cooperation and active interest, according to Director Olson.

The Institute Program.—Registration of the members of the Institute is scheduled to begin Saturday, Aug. 11th, at the University of Southern California, Bovard Administration Building, 35th and University Ave., Los Angeles. It is planned that the visiting group from the Pacific Coast and Rocky Mountain states will attend the Hollywood Bowl concert on that evening. On Sunday, Aug. 12th, as a preliminary program of the Institute, an ensemble meeting of all the sections will gather in Bovard Chapel at 3 p. m., and the delegates are to attend the Pilgrimage Play in its unique outdoor setting "en masse" on Sunday evening.

The Institute will open officially on Monday, Aug. 13th. Morning lecture sessions, luncheon talks, and afternoon round table discussions are planned, with some of the topics to be covered announced below.

The series of six sessions to be headed by William B. Munro will cover the relation of the city to the state; municipal home rule, its value and its limitations; the city charter; the mayor-and-council form of government; the commission plan of government; the organization of city departments; the city manager plan; and the forms and functions of county government.

Constitution and powers of the City Planning Authority will be the first topic under the general heading City Planning and Zoning to be headed by Harland Bartholomew; transit and

transportation plans covering grade crossing elimination, railroad terminals, and the bus in urban transportation, will follow. A model zoning ordinance; relation of zoning to the building code and housing laws; and the Board of Appeals will also be discussed. Public recreational facilities, civic centers, signs, lighting, and street trees are also listed as important lecture subjects. The cost of public improvements, public bond issues, special taxes, and excess condemnation also come under the City Planning Section of the August Institute.

Taxation, assessments, audits, and budgets involved in municipal administration will be covered in a separate section, with sessions on personal property valuation, improvement valuation, legal powers and duties of financial officers, budget control, audits of city's revenue and expenditures, and municipal reports and financial statistics.

Illustrated by lantern slides, the Section on Street Traffic Control will begin with a graphic lecture on traffic characteristics of typical American cities, by Miller McClintock, Director of the Albert Erskine Bureau of Street Traffic Research at Harvard University. The traffic accident problem with suggestions for successful methods of relief, the use of special control methods, parking and pedestrian problems, automatic and mechanical control of traffic, and community organization for traffic relief are also among the subjects to be covered.

City Clerkship Administration is scheduled for a group of intensive sessions, to include consideration of licenses, charts, election laws, legal publications, handling of ordinances and resolutions, control of purchase of supplies, and systematizing the relation to the public.

Topics to be covered in the Juvenile Delinquency and Dependency Section of the Institute include the utilization of social resources of the community, probation as social treatment, social case investigation and diagnosis, state and local institutional program, mental hygiene, and prevention of juvenile delinquency.

Special library service and facilities are being arranged with the General Library of the University of Southern California for reference use during the period of the Institute.

By special arrangement, privileges are to be extended to the members of the Institute by the Los Angeles Athletic Club, the Pacific Coast Club, the Surf and Sand Club, the Sunset Fields Golf course, and the Student Union on the Trojan campus. Accommodations for the week are to be provided at the Sigma Chi Lodge and the men's and women's dormitories at the University of Southern California.

Town Forests in Massachusetts

Some interesting information on what is being done by towns and cities of Massachusetts in the development of municipal forests is given by Charles Lathrop Pack, President, The American Tree Association, in a recent issue of The Military Engineer.

In Massachusetts, 79 towns have voted for town forests, making the state the leader in this work. In certain places, the land held for the protection of the town's water supply has been placed under the town forest act; others have taken the town farm for that purpose; and some have put under forest management the lands acquired by the town for the non-payment of taxes. A large number of towns have been fortunate enough to have received gifts of land to be used for town forests, and occasionally a memorial forest is established in that way. When none of those methods are feasible, the town is asked to appropriate money with which definite tracts are acquired.

In 1924, the town of Merrimac voted $950 for the purchase of thirty acres for a town forest, and seventy acres of the watershed which was already owned by the town for the protection of its water supply was also placed under the town forest act. Part of the land had been recently cut over and some of it contained a partly grown stand of hard woods. Since the establishment of the forest, all this land has been placed under forest managment and considerable wood has been sold, largely from thinnings. In that year, the Massachusetts Forestry Association planted 5,000 trees free of charge for the town as a demonstration plantation and those trees have made excellent growth. This work was continued by the town forests committee and, today, 32,500 young pines and spruces are manufacturing future saw logs. Trees for planting town forests are provided by the state and the only cost of reforestation to the towns is for the planting. Merrimac has made a good record in the management of its forest, because it was fortunate in having some wood to sell, and the net cost of the town forest to the town above the price of the land has been only $264.50.

Last spring, the chairman of the town forest committee suggested that the town might secure trees from the forest for street planting. The town has appropriated $200 for shade trees, and the tree warden found that the cost of shade trees ranged from $5 to $7 each, which meant that he could not plant more than 25 shade trees with the money available. Fifty trees, mostly sugar maples—an excellent tree for street planting—were taken from the forest and planted on the roadsides with unusual success. The town forest committee charged the tree warden only $2 each for the trees, thereby saving the town at least $100 and getting twice as many shade trees planted.

In Massachusetts, where the town forest idea first took root in this country, the proposition has been one largely of reforestation. There are only a few cases where the towns have secured land containing any considerable amount of merchantable timber. Petersham is an outstanding example where the town farm, which contained a wood lot of fine second-growth white pine, was made a town forest. This timber was sold for nearly as much money as could have been obtained by the sale of the whole farm.

At Fitchburg, which has the distinction of having established the first town forest in the United States under a state law, some of the land was covered with merchantable wood and the money obtained from the sale of forest products has practically equaled the cost of upkeep and of reforestation. The land is now completely stocked and the forest is in condition to produce more timber than before. Several other towns, such as Groton, have also made some sales of timber or cordwood, but, for the most part, the lands set aside for town forests are cut-over areas or worn-out pastures. While the town forest will serve many useful purposes in the future, such as timber production, water conservation, recreation, and as bird and game refuges, at the present time most of them in Massachusetts are in the making, containing only young growth and hence the outlay generally exceeds the income.

Much of the charm of the Massachusetts towns and waysides is found in the beautiful old shade trees planted by our grandfathers and their fathers. Those trees were taken from the nearby woods and planted by public-spirited citizens during their spare time, at a mere fraction of the cost of planting trees today. The people who loved trees in those days did not wait for the town to make an appropriation to do the planting, they grouped together and did the work with their own hands. At one period, tree-planting societies were organized throughout the Commonwealth, and to those organizations we owe much of the arboreal beauty of our cities and towns. The same thing can be done today. Civic, trade, booster and fraternal organizations numbering hundreds are now in existence throughout the Commonwealth.

It is easy to see the educational value of the town forest program and the results obtained. The town forest can be used to take up labor slack; it provides work and at the same time a playground. The town forest would show the value of a timber crop every year.

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A Plea for Special Freight Rates on Road Show Exhibits

American railways have been asked to grant a special rate on equipment shipped for exhibition at the annual Road Show. We understand that certain railways have replied that special freight rates are prohibited under the scheduled tariffs approved by state and national railway commissions. Doubtless this is so, but it is equally certain that these commissions will approve any convention rates that the railways may submit. The commissions have never objected to the one-and-a-half passenger fares for round trips to conventions, because it is obvious that such special fares greatly encourage attendance at conventions.

Should it be argued that exhibitors need no such encouragement, the reply is that very few annual exhibitions of heavy machinery have been repeated many years, because of the great expense involved in transporting the machinery. The Road Show, it is true, has survived even this great burden for several years; but many a former exhibitor has dropped out of the picture, and many others annually ask themselves whether it will pay to attend again.

It should be remembered that the great annual Cement Show finally came to an end because of the expense involved, an expense that consisted very largely in shipping heavy machinery to and from the show.

The exhibits at the two annual waterworks conventions have been reduced in size until many exhibitors now show only models. This reduces the value of the shows and thus tends to decrease the number who attend them.

Not only will the railway companies lose income directly if the Road Show exhibits dwindle, and the attendance declines in consequence, but they will lose much more income indirectly, for the Road Show has been one of the greatest of educational institutions. It has taught thousands of men the value of labor-saving machinery, and has stimulated the development of highways. This, of course, has added greatly to the volume of freight hauled by railways.

There may still be a few short-sighted railway officials who regard paved roads as serious competitors, and who therefore would oppose granting special freight rates to exhibitors at road shows. But the majority of railway officials have come, we believe, to regard road transportation as supplementary to rail transportation, and no more to be dreaded than air-mail transportation.

Foreigners have often said that Americans are "convention crazy"; and we are seemingly so, for we attend exhibits and listen to essays and debates on all trade and professional subjects from the hatching of chicks to the discovering of stars. Those who ridicule us as "joiners" and "attenders" are not disparaging us as "producers," for we have outstripped every nation in productive capacity. Not the least of the reasons why we are envied as the wealthiest of peoples is our joining and attending habit. It is thus that we gain much of our knowledge, by swapping ideas and by seeing the latest in mechanical devices and materials.

There is, moreover, an inspiration in meeting men of whom you have heard, and even merely in seeing great crowds of men who are engaged in the same business that you follow. The joiner and attender goes home from a convention the richer not merely in new ideas, but in confidence that he is playing an important role himself in a great industry. All this stimulates him to keep out of the ruts, to read the literature and the advertisements relating to his specialty, to scrap the old and buy the new—to be a typical American. Because he is progressive, an American consumes far more rail-hauled produce than does the typical citizen of any other nation.

Granted? Then grant also that our American conventions have aided greatly in making us the greatest patrons of railways in the world.

"We Are Just Learning to Think"

According to a recent statement by the American Research Foundation:

"Science has made more advancement of benefit to man in the last thirty-five years than it did in all previous time—and time runs back millions of years. We are just learning to think."

Called by early evolutionists "the missing link" and by recent evolutionists "the dawn man," the ape-man probably emerged during the early Miocene period, or about 1,500,000 years ago. With crude weapons and tools made of stones, wood and fibres, the dawn-man began the study of the forces of nature. Imagine him now looking from a distant planet upon the modern fruits of his ancient effort!

In a true sense, man has been learning to think since he became man, some 75,000 generations ago, but his

thinking efficiency has increased in geometric ratio only since Guttenberg printed the first book, and that means since about the time that Columbus sailed into the uncharted west to reach India and prove that the earth is round.

Archimedes and a few other Greeks had learned how to interrogate Nature systematically, and had therefore founded modern science, nearly 20 centuries before the printing press was invented, but the rebirth of science did not occur until about the beginning of the 16th century. Then we see Galileo fashioning a little instrument made of spectacle lenses held in a tube, and looking with delight upon the four moons of Jupiter which epitomized the solar system for him and gave him renewed confidence in the heliocentric theory of the monk Copernicus. If any one moment is to be chosen as the birth date of modern science that is perhaps the moment. But, as a matter of fact, science has been evolving ever since man existed, for the present methods of science are merely elaborations of the first crude methods of learning how Nature acts. Eventually it may even be proved that the trap-door spider and the honey-bee are scientific thinkers too, and thus break down our thesis that man originated science.

A physical science is a comprehensive assemblage of facts, some of which are explained by theories, and some of which are shown to have relations expressed as laws.

The first discovered kinships between facts were merely qualitative likenesses, but as man began to master the science of numbers he began to find quantitative laws. It is this quantification that has caused the recent rapid strides of science, perhaps more than any other cause, except experimentation. There is a very remarkable feature about measured relationships in natural phenomena, namely, that where the same numerical factor is found in any two quantitative laws, there probably exists the same underlying form of energy in both phenomena. Thus the intensity of light and of magnetism both vary inversely as the square of the distance; and light has been found to be an electro-magnetic phenomenon. By the same token, gravitation and magnetism are probably much alike in nature.

It has been remarked that the last inventor who has availed himself of all the work of scores of predecessors, in producing a commercial success, is often unjustly given almost the entire credit for an achievement that he really should share with a hundred other men. Are we of today not likewise seizing more credit than belongs to us when our recent achievements lead us to say that in two generations we have accomplished more than was accomplished by all our forebears in 75,000 generations? Are we not flattering ourselves a wee too much when we say that man has just begun to think?

Were men not thinking when they first used a log as a roller upon which to transport heavy weights? Were they not thinking when they put an axle through two short logs and made the first pair of wheels? What were they doing when they learned to predict eclipses several thousand years ago? And what when they first smelted iron and pounded it into spears?

Would it not be truer to say that certain men have always thought in a somewhat scientific manner, but that only recently have many men been trained so to think? And that even yet, the number trained to discover and apply the laws of nature is pitifully few. Consider that only one American in about 1,000 has had a comprehensive course in science, and that of those so trained, probably not one in ten has been taught how to discover a principle or law of nature.

The power to think has been man's as far back as we are able to trace his acts. But the leisure to think, the means of readily finding what other men have thought, and the knowledge of the most effective methods of thinking—these are quite modern, and they are enabling us to sweep forward with achievements so varied and so startling as almost to persuade us that the ancients were not such stuff as we are made of.

H. P. Gillette

Space Reservations Open for Dallas Convention

Victor E. Arnold, chairman of the Exhibitors' Committee of the Water Works Manufacturers' Association, Inc., Room 1775, 50 Church St., New York City, is soliciting exhibits for the 17th annual convention of the Southwest Water Works Association, to be held in Dallas, Tex., from October 15 to 18. The convention will be held in the Baker Hotel. Local arrangemnts are being made by Hugh E. Moore, secretary, Water Department, Dallas.

It is understood that a number of manufacturers have already reserved space, and that the convention committee has worked up a very interesting program for the convention.

Iowa Town Sells Light Plant

At a special election, recently held in Irwin, Ia., it was voted to sell the town's light and power distribution plant to the Iowa Public Service Company and obtain power from that concern in the future. The company agreed to pay the town $20,000 for its distributing plant. In the past Irwin obtained power from the town of Manilla.

Safety Convention in October

The National Safety Council will hold its annual convention in New York City in October. It is expected to bring 6,000 delegates to the city for five days, it was announced recently by Lewis A. De Blois, chairman of the New York Safety Committee and former president of the council.

"It may not be generally known," said he, "but it is a fact that New York City loses $10,000,000 annually through street congestion. If accidents can be eliminated, congestion losses will be greatly reduced. During the Congress there will be a safety exhibit on the roof of the Pennsylvania Hotel."

Port Authorities to Meet in Houston

The American Association of Port Authorities will hold their 17th annual convention in the Rice Hotel, Houston, Tex., on November 12, 13 and 14. On November 15 the convention will adjourn to Galveston for an inspection trip. The program includes papers on many live subjects by recognized authorities in the field, together with a number of inspection trips, according to Tiley S. McChesney, secretary, 200 New Orleans Court Bldg., New Orleans, La.

New Books

Labor Costs on Construction, by Frank L. Conner; 202 pp., 5¼x8 in.; Fabricoid binding; Gillette Publishing Co., 221 E. 20th St., Chicago, publisher; Price $3.00.

Labor Costs on Construction, by Frank L. Connor, is a very valuable addition to the rapidly increasing list of data books for estimators and others whose work makes it necessary that they should possess a working knowledge of construction costs.

In reality, this book is very largely a digest of several other works on the same subject, yet it presents many of the data in such new groupings that an estimator should find them especially valuable when checking up an estimate or in estimating an item somewhat out of his regular run of work.

The chapters on timber work and rough and finish carpenter work are so sketchily written that they do not maintain the same standard of excellence that characterizes the majority of chapters, but this may be due to the fact that accurate costs of work in those classifications are difficult to obtain.

On the other hand, the chapters on excavation and painting are unusually complete and the information is presented in a helpful and useable manner.

For convenience in use, a slightly smaller page size might be a decided improvement but, everything considered, the book should prove a worthwhile addition to the library of every estimator and contractor.—**Charles F. Dingman.**

Street Maintenance Organization and Operation In a Small City

An Interesting Discussion of the Common Problems of Smaller Cities

By E. A. LAWVER
City Engineer, Fort Collins, Colo.

NO set rule can be laid down for the guidance of the officials of small cities for the care and maintenance of their streets. Each city has local problems for which the officials themselves must make their own rules. All of the smaller cities, however, have certain problems in common which, because of their certainty, have become axioms.

Difficulty of Securing Adequate Funds.—It has been said that the basis of all evil is money. This may or may not be true. Anyone who has had experience with street problems, does not have to be told that the basis of all street difficulties is lack of money. This is probably the only point on which street men ever whole-heartedly agree. If you are not a street man and doubt this truth, ask any salesman of road equipment what stands between him and unlimited prosperity and the answer will be stated briefly but sadly, in the tone of Poe's raven, "Lack of money. Never more."

No matter how much scheming is done or how much pressure is brought to bear, the budget which is allowed for streets is always short of the actual needs. What is the reason? One of the chief reasons is that the cost of street work cannot be definitely stated. In other words, if the cost of snow removal for the year would be $2,089.61 and road dragging would be $3,148.16, and so on through the regular routine, and if quotations and convincing figures were available, the amount of the budget would be much more easily obtained. Other departments, because of the certainty of their work, can come more nearly doing this. For example, the police department can itemize its probable expenditures to such a degree of exactness that the amount asked for incidentals is a minor item. The item of salary is clearcut, for this department knows a year in advance that a given number of patrolmen will be employed. It knows that a definite number of uniforms are to be purchased; that a new motorcycle will be bought, etc., and that the balance listed as incidentals will be ample for the purchase of gasoline, oil, flashlight batteries, and other small items. In general, the same thing is true of the fire department. In this department, the unexpected expenditures are a trifle higher, but nevertheless they are an insignificant percentage of the whole amount.

When the various tabulated budget requests are laid on the table before a committee that is to determine the tax levy and distribute the funds for the coming year, the indefinite compilations of the street department draw the fire of each and every member of the committee except the street department representative.

This committee usually has determined beforehand that taxes must be cut and the "strictest economy" must be practiced. Very often a definite number of mills has been arbitrarily decided upon in advance. As a result of this, almost the entire cut is taken by the street department.

It is for this reason that items for necessary equipment are often struck from a budget. Assume that a request is made for a 2 ton tractor costing $2,000 to replace flushers and trucks for dragging. The same preliminary budget contains an item of $2,500 for blading and dragging. In order to make a $1,000 cut, some wiseacre will say that in his opinion $1,500 is entirely enough for this purpose. And then after this amount has been agreed upon, some other wisehead will suggest that inasmuch as there is to be only $1,500 spent, it will do no harm to use the flushers and trucks as before. The item for a tractor is, therefore, eliminated and the smirk of "strict economy" settles over the group.

There are too many boards who seem to think that, merely by setting a figure like the $1,500 in the above illustration, the amount of work is predetermined. They seem to forget that no one has as yet found means of controlling the weather and that after each storm blading and dragging must be done. The same kind of tactics force the street department to wear out equipment on duties for which it was never designed. Did anyone ever see a fire truck used for dragging streets? No. It is not designed for that purpose! Neither is a flusher, but using one on a drag is common practice. I have seen $8,000 flushers worn out in half the usual time because some bright economy hound has lopped off an $1,800 tractor item.

A true, dyed-in-the-wool street man always has hopes (which will probably die with him) that some day this will be different. He won't always be compelled to hand a man a pitchfork and tell him to hoe weeds with it. The taxpayers are demanding more than ever before that their streets be improved and kept in tiptop shape, but at the same time they are crying for the low taxes which were collected when knee-deep mud was the style.

These are a few of the things which the street department men in a small city must overcome or, more strictly, with which they must contend in order to perform their tasks. This is the foundation on which first-class service is supposed to be based. Is it strange that the results are not always perfect?

Essentials of an Ideal Organization.—In further discussing the subject of street maintenance, organization and operation in the small cities, it will be assumed that the street department has at last been put on the same basis that any good business enjoys and that it is not hampered by inadequate funds or lack of equipment. By this neither an overbundance of equipment nor an unlimited budget is meant, but that there is just enough of each to perform the work economically and efficiently. Local conditions and size of city will determine to a considerable extent the kind of equipment needed as well as the size of various items in the budget.

The first essential of an efficient business is a well-balanced organization. The head of the department should be a man who is familiar with the business of streets. He should have had considerable experience in handling men and must be a person of sufficient tact to deal with the public without undue irritation. This man should supervise and not be expected to devote a great deal of his time to the details of the work. His entire time need not be devoted to the street department, hence he may also serve as city engineer or city manager.

The detail work should be in the hands of a street foreman who gives the work his full attention. It is his business to see that the work progresses smoothly and that it is done promptly and efficiently. This man, as well as the department head, must have the ability and experience to handle men, and he must be familiar with the various phases of street work and the equipment related thereto. The street foreman must see that the work within the department is handled properly

while the department head must look to the proper functioning of the department externally, particularly in its relationship with the public and the other departments.

The Personnel.—The personnel under the street foreman's immediate charge varies considerably with the time of year and the nature of the work. A few experienced men are employed the year around as a skeleton organization. These men, most of whom come "from the ranks," are classified as skilled laborers and mechanics. This group consists of one head mechanic whose duty it is to keep the equipment in good working order. He has complete authority over the equipment and is held responsible for its condition. This position requires a man well versed in gas engines and one with wide experience, for he has a variety of equipment in his charge.

The remainder of this group consists of truck drivers, mechanics, and teamsters who, aside from their regular vocations, must be able to use a lathe, do blacksmith work, welding, carpentering, blading, and other odd jobs. Above all, this group of men should not be the kind who hesitate when called upon to use picks, shovels, or other tools of the common laborers.

With this organization a vast amount of work can be done by merely adding unskilled labor when the necessity arises. Furthermore, the men comprising this organization can be kept at useful employment, such as overhauling equipment, during the winter months when the outside routine work is slack. Practically no repair work will be done in outside shops if the proper shop facilities are provided.

Equipment.—With reference to the kind of equipment and the amount of tools which the city should own, there is little to say except that there should be enough of the right kinds to produce economical and skillful results. These results cannot be accomplished by trying to use a pitchfork for a hoe nor by allowing the equipment and tools to be used without keeping them in good repair. It is necessary to obtain the right equipment for the particular job and see that this equipment is hitting on every cylinder all the time.

Every city should have a good shop of sufficient capacity for its needs. Plenty of light and heat are required if the mechanics are to work efficiently. The shop should have the various labor-saving devices commonly seen in the shop of any successful privately owned company. There should be a lathe and drill press, cutting and welding equipment, and other similar machinery. The city shop should be on a par with private shops in the city which are handling an equal amount of business. If it pays the private concern, it will surely pay the public.

The man who works for the city has the same pride in his work as the man who works in the private shop if he is given equally considerate treatment. The major part of the total cost of city work is labor and the small amount spent for better tools will greatly increase the output of the labor. Unfortunately, the shop of the smaller city is usually a mere hole or cave containing a few poor tools long since worn out. Too many city fathers are reluctant to improve these conditions, claiming they cannot afford to spend the amount needed for an up-to-date shop. This is a favorite item to be eliminated or reduced when some one has the audacity to mention it in the budget. Intentionally or otherwise, officials who trim this item are also trimming the public.

With a good shop as a start, the next thing to be considered is the equipment. The speaker is not going to mention the product of any particular manufacturer. There is much good equipment on the market from which to choose any particular machine. A standard brand of equipment should be selected. The suggestions of the foreman will probably be helpful. An inspection trip to see the machine in operation is extremely desirable. A talk with the operator when he is alone, and also with the mechanic who repairs the machine will be of assistance. A decision can be made much more intelligently after this information has been obtained.

Street Maintenance. — Inasmuch as the bulk of street work in smaller cities is maintenance after storms, that phase will be considered first. The smaller cities, as a rule, have the majority of street surfaces unimproved. It is these streets which require the greater amount of attention. If the soil is naturally sandy, the city is fortunate, but if the soil is adobe or clay then there is a real job for somebody. Under the latter conditions, there must be considerably more equipment and the task, in addition to being more difficult, must be performed in a shorter length of time. The rapidity with which a street is put in shape after a storm will depend largely on the condition of the street before the storm. If the best results are to be secured, a clay or adobe soil must be prepared for the next storm while the moisture of a preceding storm is still very much in evidence. This soil should be worked with light continuous tread tractors and medium weight drags while it is still possible to obtain a puddling effect. The ruts should be filled with sticky mud which is glazed over by the sliding action of the drag, thereby producing a surface which will be more nearly impervious and consequently more difficult to rut.

Blades which are drawn by continuous tread tractors should follow the drags. New gutters should be cut and the distorted crowns should be worked into shape. This work should be done before the soil has crusted and while it is still possible for the moved material to bond with the undisturbed portion. After this treatment, the streets should be let alone until after the next storm.

If an attempt is made to shape clay streets after they have dried, the result will be an abundance of dust or loose clods easily whipped out of the ruts and a soft, impassable roadway as soon as a storm sets in.

In the writer's opinion, a truck is not suitable for this class of work. It is in this soil, particularly, that the truck which is used for dragging is most abused. If the truck is put to work when the soil is in the proper condition to give the best results, it cannot get traction and succeeds only in cutting enormous ruts unless it is so fortunate as to immediately bury itself to the hubs. When the soil has dried sufficiently to permit traction, a drag will only bounce over the surface. In either case little has been accomplished.

It is understood that the above remarks apply to heavy soils. By heavy soils is meant clays and adobes which are practically devoid of grit. This is the kind of earth that made the sugar beat famous because the sugar beet thrives in it, but such soil is not suitable for road material.

As has been said before, it is utterly impossible to state definitely the number of the various machines or pieces of equipment necessary for a small city, for there are too many variable conditions. To illustrate: It is very seldom that the speaker does not hear this or similar remarks when he mentions that he is from Fort Collins: "Oh, yes! I remember it. It is the city with such nice wide streets." Fort Collins is proud of its wide streets; but it must pay a price for this luxury.

Wide streets cost more to maintain than the narrow ones. Unfortunately, the cost of street maintenance is proportional to the square yard of surface instead of to the linear foot of street. Also, a wide street in muddy weather gives each vehicle a chance to make a new rut. A half dozen autos on a wide street in a residential district can cause considerably more maintenance than a constant stream of cars on a narrow thoroughfare. The reason is apparent. Many cars will smooth out and pack the soil if they are held within narrow limits; while a few cars, when given a broad street on which to travel, leave a corresponding number of miniature canyons.

A drag or blade is limited in size by the power which pulls it. A wide street may require six or eight trips to cover its area, while a narrow one is often covered in three trips. As time is the important element in street dragging, much more equipment must be at work simultaneously on wide streets than on the narrow ones even though the mileage of streets is the same. An increase of equipment means

an increase of men, gasoline consumption, and other expenses.

Then, too, wide streets discourage improvement because the cost is greater than for similar work on narrow streets. The result is that they continue to be muddy streets for a long time after the narrow ones are paved.

Graveled streets help to increase the length of time in which streets can be effectively maintained because they drain and dry much faster than do the clay type. This permits the equipment to be at work much sooner after a storm than if all the streets were of clay. Also, they can be worked after they are dry with less harmful effect. This is especially true if the gravel on the surface is moderately fine. However, the most permanent results are secured while the surface is quite wet.

The tractors used in dragging and blading have many other uses in city work. One of the most important uses is in connection with snow removal. There is no better equipment than the tractor for clearing the roadways and windrowing the snow. It can be used also as a stationary power plant for running gravel screens and crushers and for other similar purposes. There will be few days in the year when the tractor is not put to some good use.

Every street department should be well supplied with small 1½ or 2 yard dump trucks. These are low in first cost, the upkeep is small, and they can be used efficiently at all times of the year. While they are somewhat too small for bulky snow, still they dump easily and move rapidly and are, after all, very economical for this purpose. During all times of the year they can be kept busy hauling trash and rubbish. If there is dirt to move, or gravel to spread, the city-owned fleet can be relieved temporarily of its other duties. Any city which has not tried this method of hauling is still in the horse and buggy stage.

Snow Removal.—In street work in this climate, it may be necessary to sprinkle dusty streets industriously today and to shovel snow tomorrow. Of all the uncertain yet costly jobs that fall to the street department, snow removal is the worst. Within the last few years there has been an ever increasing demand to keep the business streets in the small cities cleared of ice and snow. There is not enough snow in this part of the state to warrant the use of snow loaders. In localities where snow falls often and to considerable depth, loaders are a necessity. All snow should be removed as quickly as possible during the time of year that it melts slowly. Snow should be removed first from the shady side of the streets. Extra men should be hired and all tractors and trucks should be put to work. It is important to remove the snow as quickly as possible because it may quickly turn to ice and the cost of removal is thereby greatly increased.

During the winter, the mud which drops from parked cars really causes more trouble in cleaning than any other one thing. The big cities are not troubled to the extent that the small cities are, because most of their streets are improved and are, therefore, not mud producers. The small city, however, has to contend not only with the city cars traveling over muddy residential streets to the business district, but with cars which go from the country roads to the heart of the city. The mud which falls to the pavement in a half frozen condition quickly adheres to it. It is almost impossible to remove this mud while the cold winter weather continues, consequently the mud may accumulate until the first warm weather of spring approaches. During the daytime, the surface of this mud will melt, causing a decidedly unkempt appearance as well as a muddy street.

The real street supervisor always has an eye on this mud and at the first sign of a thaw his gangs are hard at work with crowbar and shovel. During this season of the year, much may be heard about the inefficiency of the street department.

Street Cleaning.—The business streets during the rest of the year are readily kept clean if parking is prohibited at certain hours of the night. All cities with sufficient pavement should own a motor driven flusher and sprinkler. A pick-up broom, while not an absolute necessity, will quickly pay for itself during certain times of the year. It is believed that a street in the business district can be cleaned better and quicker by a flusher than by a motor driven pick-up sweeper, but when cold weather comes, the flusher cannot be used and the sweeper is invaluable. All cleaning in the business district should be done at night with the exception of the work of the push-cart patrol. Occasionally, during the winter, a flusher can be used in the middle of the day to wash the center portions of the streets. Much care must be exercised when this is being done to prevent motorists and pedestrians from being spattered.

The pick-up broom can be used during the daytime on the improved residential streets when they are dry. The type of machine with a good gutter broom is invaluable when the leaves are falling. Dump trucks should carry away the rubbish as fast as it is collected by the sweepers. The speaker knows of no better way to handle the leaf problem.

The speaker believes that he has touched on most of the items of importance in street maintenance organization and operation in a small city.

Nothing has been said about the maintenance of paving. The speaker is not qualified to speak on any kind of paving maintenance other than concrete and there is little of that to be done in Fort Collins. Fort Collins has 285,000 sq. yd. of concrete paving, but maintenance is included in minor items of the budget. To say anything more about the maintenance of gravel streets would probably not add much to this discussion. Street maintenance and operation are questions which are likely to bring out interesting discussion which will probably add to the fund of available knowledge on this subject.

Acknowledgment.—The above paper was presented at the 1928 Highway Conference at the University of Colorado.

City Officials Organize Division of American Road Builders Association

Capt. H. C. Whitehurst, assistant to the engineer commissioner of the District of Columbia, was elected president of the City Officials' Division of the American Road Builders' Association at the organization meeting held June 8.

The new division adopted a constitution and formulated plans for carrying out the objectives for which the division was organized. Chairmen of four major committees were subsequently appointed. Captain Whitehurst heads the Committee on Administration and Organization; George B. Sowers, Cleveland, the Committee on Design and Construction; C. E. Myers, Philadelphia, the Committee on Maintenance; and M. O. Eldridge, Washington, the Committee on Traffic. Each of these committees will have various sub-committees.

Twenty-four states were represented at the session. Charles M. Upham acted as temporary chairman. Col. R. Keith Compton, chairman of the Richmond, Va., Department of Public Works, addressed the assembly. He told of the need for a city officials' organization, and visualized the services it could render to the cities of the United States. Colonal Compton has been a city official for a long period of years.

In addition to the president, the following officials and members of the board of directors were elected:

President, Capt. H. C. Whitehurst, Washington, D. C.; secretary, Chas. M. Upham, Washington, D. C.; treasurer, James H. MacDonald, New Haven, Conn.; vice-presidents, C. E. Myers, Philadelphia, Pa.; Ben S. Davison, Houston, Texas; W. R. Hopkins, Cleveland, Ohio; John C. Shaw, Los Angeles, Calif.

Directors—Robert B. Brooks, J. P. Broome, W. P. Cottingham, R. M. Gregory, W. J. Jamieson, Chas. Henry Moon, Bryson Vallas, A. D. Butler, C. E. Clarke, Thomas B. Crutcher, Wm. A. Hansell, H. C. McClure, H. E. Nettleton, Ira T. Redfern, A. Mason Harris, O. Laurgaard, Thos. B. Oakley, Harry C. Shaner, Nathan L. Smith, Geo. B. Sowers, James H. Sullivan.

Methods of Resurfacing With Emulsified Asphalt Penetration Macadam in European Countries

Notes on the Practice That Could Be Applied as Well on City Work

By C. L. McKESSON
Materials and Research Engineer, California Division of Highways

MOST of the highways in the European countries have been macadamized for many years. These existing macadam surfaces are frequently utilized without the addition of metal by the simple expedient of surface treatment with emulsified asphalt or tar, but where the road surfaces are more or less irregular or worn the reconstruction practice usually takes the form of penetration macadam resurfacing.

Construction Methods Similar to Ours.—Penetration macadam resurfacing is, in general, constructed in accordance with the approved practices with which we are familiar. Emulsified asphalt has, however, become quite popular in this type of work instead of the ordinary hot asphalt or road oil, and this popularity may be attributed to the ease with which the material can be applied even in unfavorable weather, to the simplicity of the equipment, as well as to the very satisfactory work which has been thus produced. Interesting examples of this work were found in England, France, and Germany. The following descriptions of work as conducted in these countries will show the striking similarity to penetration macadam as we have constructed it in this country, but will also bring out some differences of practice which are made practicable by the difference in form of the bituminous material used.

It should be borne in mind in this connection, that emulsified asphalt is simply a standard asphalt which has been made liquid by the addition of water and a very small amount of emulsifying agent and that, when the emulsion breaks down, the water leaves the road and the asphalt remains in the form of a thin layer over the rock particles. Emulsified asphalt roads at this stage do not differ from roads constructed thinner and there is a marked absence of displacement sometimes noted where excessive amounts of bitumen have been used in hot penetration work. There is also an entire absence of "bleeding" and the texture which results is usually of a type which could be classified as non-skid due, probably, to the thinness of the coating on the rock particles and to the absence of excessive richness in the surface of the road.

Penetration Resurface Over Old Macadam.—Figure 1 is a view of work under way on Leighton-Hockliffe Road, in Bedfordshire, England. This work consists of a penetration resurface over an old tar treated macadam surface. The inspection was made on a damp, misty day and the depressions in the old road surface were filled with water as is shown in the illustration. This, however, did not deter the construction forces. Mr. Mann, the Division Engineer in charge, stated that they had no difficulty in working in this kind of weather and, as there is considerable rainy weather in England, the ability to use emulsified asphalt under this condition is one of its valuable qualities. The engineers accustomed to using it, however, do not recommend carrying on work of this kind during freezing weather.

Figures 2 and 3 are other views of the resurfacing work in the Leighton-Hockliffe Road. Due to the fact that this road is a heavily traveled main highway it was necessary to construct a macadam resurface on one side of the road at a time, allowing traffic to use the other half of the road. In constructing the macadam resurface a very thin layer of sand was first distributed over the old tar macadam. The engineer explained that this was to intercept the emulsified asphalt which penetrates the rock surface and to prevent it from running out to the shoulders. The next stage is to spread a uniform layer of crushed stone which passes a screen having 2 in. circular openings and which is retained on a screen having 1¼ in. circular openings. This material is spread by hand and is rolled lightly with a 10 ton roller to bring out irregularities in the surface. These irregularities are carefully corrected by loosening up and adding more stone where required or by removing stone. After the surface is smooth and uniform a light covering of stone chips was distributed over the surface, as shown in the photo, and swept into the rock. This, the engineer explained, was done to prevent the liquid emulsion from running through the metal too quickly. A comparatively small amount of chips was used at this stage and the voids only partially filled. Excessive rolling at this stage is carefully avoided; the purpose of the rolling being merely to develop irregularities so that they can be corrected.

The emulsified asphalt for this work was shipped to the job in metal barrels and applied with hand pouring-pots. The emulsified asphalt pours readily from the barrel and is distributed with remarkable uniformity with the pouring-pots. The first application consisted of 1.64 (U. S.) gal. After this application stone chips were distributed over the surface and swept in until the voids are entirely filled; rolling continuing during this operation. After the surface is thoroughly compacted and filled a seal coat was applied in similar manner using .41 gal. of emulsified asphalt per square yard. This was followed with a cover coat of chips and again rolled.

Figure 4 is a section of this road finished in the same manner several weeks before the inspection. It will be noted that this macadam resurface which is 2½ in. to 3 in. finished thickness used slightly more than 2 gal. per square yard of emulsified asphalt. The emulsion was made from Grade "E" 200 penetration asphalt and contained approximately equal parts of asphalt and water. The actual amount of asphalt used in the road is, therefore, about 1 gal. per square yard. This is about one-half the amount of hot asphalt that would ordinarily be used in this country in a penetration macadam of the same thickness. Inasmuch as the road was well bound and apparently well sealed it is apparent that this result must be made possible by reason of thinner coatings on the particles. The actual amount of bitumen used is apparently about 3 per cent of the weight of the road metal, which is estimated to be about 270 lb. per square yard. This would correspond quite closely with the amount of bitumen which would be used for the same grading in hot plant mixed work.

Figure 5 is a view of another Bedfordshire road with emulsified asphalt penetration surface.

A German Resurface Job.—Figure 6 is a view of the main international road between Neuss and Aachen, Germany. This highway was surfaced many years ago with waterbound macadam over a Telford base. In November, 1926 a 2 in. resurface was constructed in much the same manner as the Bedfordshire resurfacing already described. The first course of stone was from 1¼ in. to 2 in. in size. This was filled with ⅜ in. to ¾ in. screenings, rolled and then given a first application of 0.88 gal. per square yard

of emulsified asphalt. After screening and rolling a second application of 0.44 gal. per square yard of emulsified asphalt was applied. The second application was covered with stone chips from 10 mesh to ¼ in. and a seal coat of 0.22 gal. per square yard of emulsion was applied. This, in turn, was covered with a light coating of the same chips. The

Penetration Macadam Construction in England, France and Germany

(1) Leighton-Hockliffe Road in Bedfordshire, England. (2) Macadam Resurface Construction Over One-half of Road. (3) Applying Emulsified Asphalt. (4) Completed Section of Road. (5) Emulsified Asphalt Penetration Surface on Bedfordshire Road. (6) Main International Road Between Neuss and Aachen, Germany. (7) Penetration Macadam on Nurburg Ring in the Eifel Mountains, Germany. (8) Texture of Pavement on Nurburg Ring. **Fig. 9.—Penetration Macadam on Highway Between Bonn and Trier, Germany**

emulsified asphalt was applied by hand as in the Bedfordshire work. Stone paving-blocks were laid along the edge prior to resurfacing and the resurfacing finished flush with the tops of these header blocks. The resurfacing has a fine texture somewhat resembling Topeka pavement due to the fineness of the stone chips used for covering. It was stated that 60 per cent of this work was done during the rain.

This main highway is in a thriving industrial center and carries a very heavy volume of truck and passenger traffic. There was no evidence of rolling, corrugating, or other displacement and the surfacing appeared to be meeting all traffic requirements.

Penetration Macadam on German Race Course.—Figure 7 shows an emulsified asphalt penetration macadam surface on the Nurburg Ring in the Eifel Mountains, Germany. This is a section of mountain race course 20 miles in length built for use in international auto races. In the construction of this race course the German engineers built sections with each of the types of surfacing most commonly used in Germany for the purpose of studying relative value of the types. The sections included emulsified asphalt penetration, emulsified tar penetration, Tar-Mac, cement concrete, and Essner natural asphalt. The surface, in general, consists of a Telford base about 8 in. in thickness and a macadam surface about 4 in. thick. The section shown in the illustration has a surface consisting of rock from ¾ in. to 1¼ in. in size in sufficient quantity to form a penetration macadam of 2 in. compacted thickness. From 1.3 to 1.5 gal. of emulsified asphalt was applied per squarel yard in three applications with ¼ in. to ⅝ in. stone chips between. On this section the sub-soil is a heavy clay and some difficulty was experienced due to the clay coming up into the macadam. It was necessary to scarify and reroll some of the macadam base before the treatment, and in a few places water was coming from the subgrade through the pavement and surface and running to the sides of the roadway. In spite of this unfavorable condition the road was found to be reasonably smooth and without any breaks or evidence of repairs. There were short sections of grade up to 17 per cent. Figure 8 shows the texture of the pavement.

Penetration Macadam in a Military Road.—Figure 9 is a view taken at Rossburg on the highway Bonn to Trier, Germany. This is a military road built by Napoleon. Early in 1926 a macadam surface was constructed consisting of a basalt with sand for filler 3½ in. to 4 in. in thickness. This, in turn, was covered with 1¼ in. to 2 in. crushed basalt sufficient to form a wearing surface about 2¾ in. in thickness. The wearing surface received a treatment of about 1.25 gal. per square yard of emulsified asphalt, was covered with stone chips and thoroughly rolled. One year later the road received an additional 0.22 gal. of emulsified asphalt per square yard and additional stone chips. The road surface was found to be smooth and uniform with a good non-skid texture. It is on a grade ranging from 5 per cent to 7 per cent. The cost of this bituminous macadam surface was given by the engineer as 75 ct. per square yard. Emulsified asphalt brings $35.00 to $40.00 per ton in this locality. Labor costs are about one-half those in the United States.

Penetration Macadam Over Old Stone-Block Pavement.—On National Route 20 at Chevilly, France a penetration macadam surface has been constructed over an old stone-block pavement. The surface consisted of ¾ in. to 1½ in. rock spread to a thickness of 2 in. and rolled. The stone chips, ⅜ in. to ⅝ in. in size, were distributed over the course of stone and rolled in. 1.4 gal. per square yard of emulsified asphalt was applied in one application and given a light cover of stone chippings. Rolling was continued until the road was thoroughly compacted. Three weeks after, the surface was washed and the roadway received a seal coat of 0.33 gal. per square yard of emulsified asphalt and another cover of stone chips. It was not rolled after this seal coat. The cost of this surfacing was 60 ct. per square yard.

Acknowledgment.—The matter above is taken from a paper presented by Mr. McKesson at a meeting of the Western Association of State Highway Officials.

Exhibitors at Montreal Convention

The following manufacturers and publications have signified their intention of maintaining exhibits at the Montreal Convention of the New England Water Works Association, to be held from September 18 to 21, according to V. E. Arnold, chairman of the Exhibit Committee of the Water Works Manufacturers' Association, Inc., sponsors of the exhibits:

1. Pittsburgh Equitable Meter Company.
2. Thompson Meter Corporation.
3. Neptune Meter Company.
4. Water Works Engineering.
5. The American City.
6. Pittsburgh-Des Moines Steel Company.
7. Engineering News Record.
8. Ross Valve Mfg. Co., Inc.
9. R. D. Wood & Company.
10. Lead Lines Iron Pipe Co.
11. The Pitometer Company.
12. United States Cast Iron Pipe & Foundry Co.
13. The Kennedy Valve Mfg. Co.
14. National Tube Company.
15. Hersey Mfg. Company.
16. Builders Iron Foundry.
17. The Canadian Engineer.
18. Geo. A. Caldwell Company.
19. The Federal Meter Corp.
20. The A. P. Smith Mfg. Co.
21. Paradon Mfg. Company.
22. Union Water Meter Company.
23. W. & L. E. Gurley.
24. National Meter Company.
25. Red Hed Mfg. Co.
26. McWane Cast Iron Pipe Co.
27. Wallace & Tiernan Company, Inc.
28. Public Works (Journal).
29. The Central Foundry Company.
30. Worthington Pump & Mach. Corp.
31. Rensselaer Valve Company.
32. Hydraulic Development Company.
33. Edson Mfg. Company.
34. Badger Meter Mfg. Co.
35. Gillette Publishing Company.
36. Gamon Meter Company.
37. Buffalo Meter Company.
38. Mueller Company.
39. Lock Joint Pipe Company.
40. Eddy Valve Company.

Especially interesting exhibits have been planed by these exhibitors. *Municipal News and Water Works* will, of course, be well represented.

Wilmington, Del., to Build Wharfage

The finance committee of city council of Wilmington, Del., was authorized by council at a recent meeting to arrange for the sale of city bonds to the amount of $350,000 for the purpose of erecting the new 1,400-ft. wharfage addition to the Marine Terminal. Work on the new addition will be started immediately, and until the sale of the bonds is actually made, the expense of the work will be paid from an appropriation of $20,000 which was transferred by special resolution recently from the Special Account Bond Sales to the Special Account Harbor Improvement. The issue of the bonds will probably be made by the finance committee before the end of summer. The addition will be built by the McLean Contracting Company, of Baltimore.

Street Sanitation Officials Meet in Toronto

The International Association of Street Sanitation Officials will hold their 9th annual conference in Toronto, Canada, on October 8 and 9. The headquarters of the conference will be at the King Edward Hotel. A number of interesting authoritative papers on garbage disposal, street cleaning, rubbish disposal, and other pertinent subjects have been announced. Attention will also be given to snow removal, air ports, public parking spaces, comfort stations, department records, advertising matter, complaints, and subjects of interest. A. M. Anderson, 10 So. La Salle St., Chicago, is secretary of the organization.

Rational Design of Asphalt Paving Mixtures For City and Rural Pavements

Research Data Confirming Voidage Basis of Design Given in Paper Presented at Recent Convention

By HUGH W. SKIDMORE and GENE ABSON
Directors, Chicago Paving Laboratory, Chicago, Ill.

DURING more or less continuous investigation of asphalt paving mixtures in the past eight years, we have developed a rational method of designing such compositions. At various times, certain phases of these researches have been reported. All of the information obtained during these years of study seems to constantly and convincingly lead to one outstanding conclusion, viz., that the voids in the dry aggregate normal to sheet asphalt and asphaltic concrete (and all modifications thereof) if correctly determined, establish the quantity of bitumen necessary to satisfy not only practical considerations, but also extended laboratory investigation. Some have reserved acceptance of such a rational design awaiting more convincing proof of a theory. It is believed (after considerable investigation of field mixtures) that even those who, up to this time, have argued that such a premise does not satisfy prior hypothetical considerations, are actually (though unwittingly) following the tenets of the voidage principle.

Design Actually Worked in Field Practice.—Early in our researches into this ever-widening subject, we encountered results both in the laboratory and in the field, which convinced us that such a method of design had some foundation in scientific fact, and possessed the important advantage of actually working out in field practice. Our more recent study has been conceived in a true research attitude of searching for facts that will either prove or disprove our so-far acceptable conclusion, or will bring out indications of another line of reasoning. These latter studies have been directed toward single lines of investigation, rather than "hit or miss" experiments along general lines.

About a year or so ago we undertook a study of aggregates along restricted lines, starting with a sand of one size and systematically building up graded aggregates therefrom. Sand for the major investigation reported here, was obtained from local supplies of sand commonly used in asphalt paving work, known as Lake Michigan sand. It is hard grained, almost pure silica, of more or less waterworn particles, the finer particles being the sharper. A large supply of this material was separated into its various sizes by means of 80, 40 and 10-mesh sieves, and recombined by weight according to specific formula. The sand contains uniformly almost no material passing a 200-mesh sieve and very little retained on 10-mesh. The intermediate sizes sometimes used, have been found to be an elaboration of no practical value, hence were not used beyond the initial sieving of raw sand. In every case of aggregates other than Lake Michigan sand, they are specifically identified.

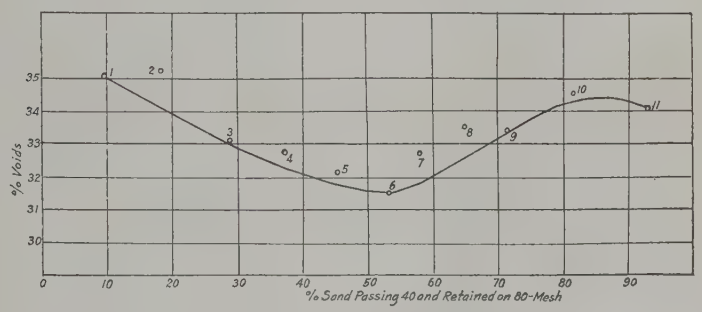

Fig. 1.—Voidage with Respect to Ratio of 40-Mesh to 80-Mesh Sand in 80-40 Combination, Starting with Particles Passing 80 and Retained on 200 and Adding Particles Passing 40 and Retained on 80

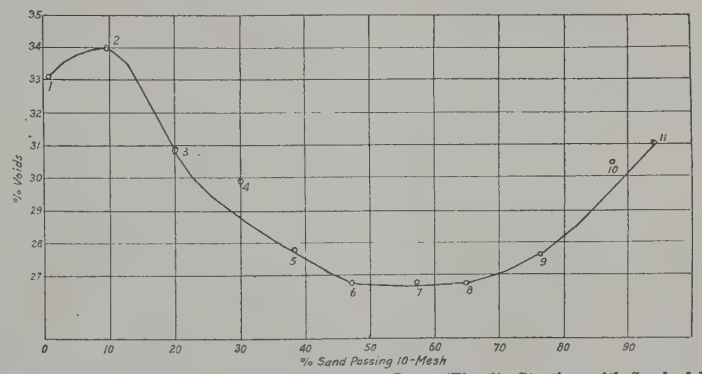

Fig. 2.—Effect of Adding 10-Mesh Sand to Point 3 on Curve (Fig. 1), Starting with Sand of Exact Grading of Point 3 and Adding Sand Passing 10 and Retained on 40

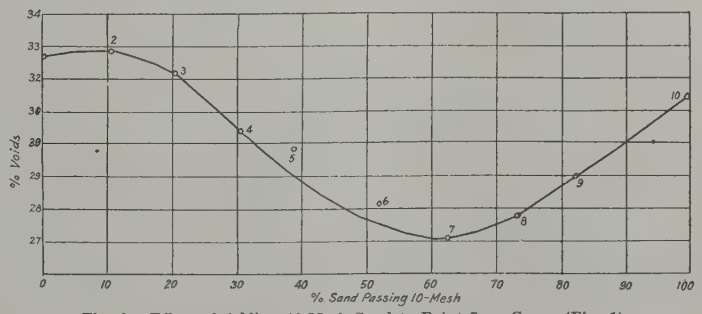

Fig. 3.—Effect of Adding 10-Mesh Sand to Point 7 on Curve (Fig. 1)

From here on, a logical discussion of the work becomes a study of Figs. 1 to 13.

Combinations Common to Natural Sand Grading.—Beginning with a sand passing 80 and retained on 200-mesh, particles passing 40 and retained on 80-mesh were added in 10 per cent increments. The curve (Fig. 1) shows a gradual decrease in voids to about 50 per cent, 40 and 50 per cent 80-mesh,

then a gradual increase as the 80 sand approaches zero per cent. This offers a variety of ratios of 40 to 80-mesh for further study by the addition of sand passing 10-mesh and retained on 40-mesh. Three such combinations were chosen:

	Points on Curve 80-40 S		
	Point 3	Point 7	Point 9
Passing 200-mesh	2.0%	1.9%	1.0%
80-mesh	69.4%	39.8%	27.2%
40-mesh	28.6%	58.3%	71.8%

This gives us three distinct combinations quite common to natural sand grading, viz., high 80, low 40; 40 somewhat above the 80; and high 40, low 80.

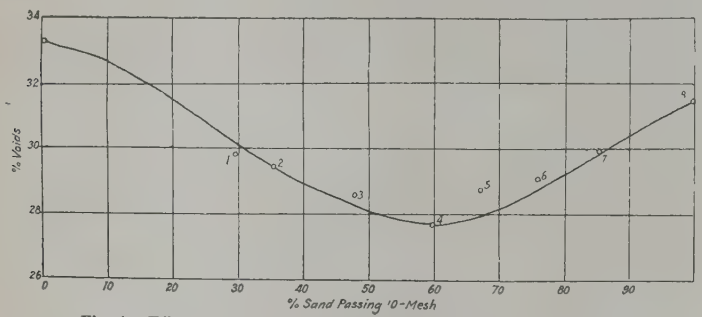

Fig. 4.—Effect of Adding 10-Mesh Sand to Point 9 on Curve (Fig. 1)

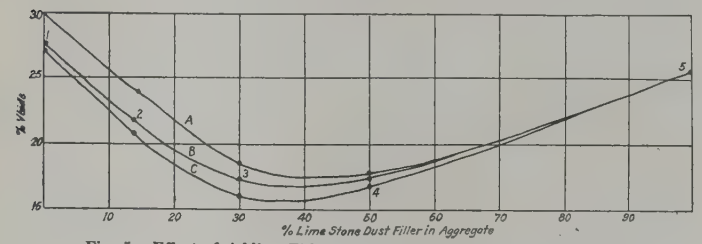

Fig. 5.—Effect of Adding Filler to Sands of Various Original Grading

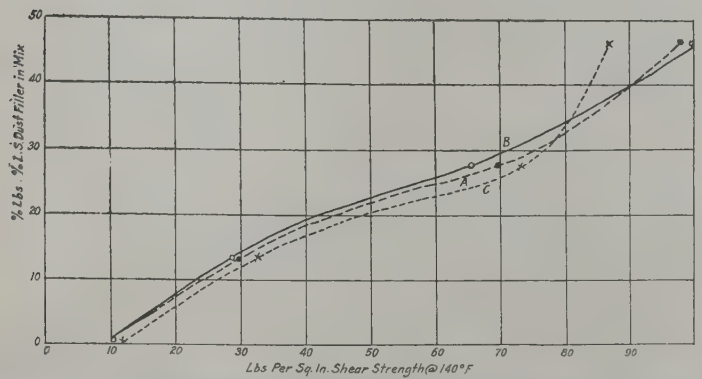

Fig. 6.—Shear Strength-Filler Relationship. Mixtures Designed from Curves (Fig. 5) with A. C. (40 Pen. Mex.) Just Filling Voids in Aggregate

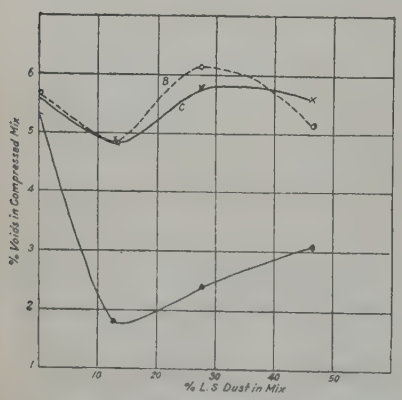

Fig. 7.—Relative Compressibility of Mixtures Designed from Curves (Fig. 5) with Bitumen Filling Voids in Aggregate

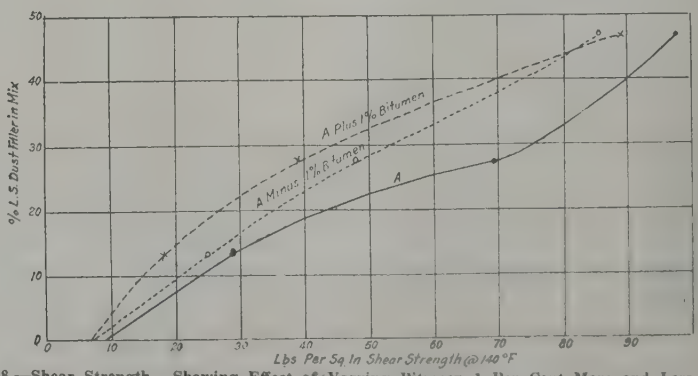

Fig. 8.—Shear Strength. Showing Effect of Varying Bitumen 1 Per Cent More and Less Than Amount Required to Fill Voids in Dry Aggregate

Effect of Adding 10-Mesh Sand.—By adding 10-mesh particles to a high 80, low 40 sand we note (Fig. 2) the lowest voids occur between 40 and 70 per cent of the coarsest material. This gives us quite a wide range of low voidage sand with respect to the exact amount of 10-mesh, but it does show very conclusively, what we have always known from experience, that a fair amount of coarse sand between 10 and 40-mesh is essential to low initial voids.

In Fig. 3 we note the effect of coarse particles upon a moderate 80-40 combination, and again we see that the lowest voids are accomplished with a fairly high percentage of 10-mesh. Note especially that the lowest voids on the curve (Fig. 3) are almost identical (27 per cent) with those on Fig. 2.

In Fig. 4 we see the effect of 10-mesh sand upon a low 80, high 40 ratio, which is not at all uncommon in natural sand grading, and is frequently almost impossible to correct by any combination of available materials. You will again note that 60 per cent of 10-mesh gives the lowest voids, and also that voids do not go quite as low with this ratio of 80-40 as with either of the others.

Effect of Filler on Sands.—We now approach a more complex problem, that of studying the effect of filler upon sands of various normal grading. It would be impossible to show this study complete, so we select gradings that characterize some of our more common field conditions. Three such original sands are selected for study in combination with limestone dust filler of excellent quality, the same being a ground limestone from Quincy, Ill., one representing what we have always felt gave best results in actual practice; one high 80 and 10, with low 40; and one with low 80, medium 40 and high 10, which is common to coarser sand sometimes found necessary to use. A fourth combination of high 80 and 40, with very low 10-mesh, could have been added, but it is productive of such high voids as to be considered wholly undesirable. These three sands show original gradings as follows:

	Point No. 1 Curve 80-40 S 9	Point No. 5 Curve 80-40 S 3	Point No. 7 Curve 80-40 S 7
Passing 80-mesh	25%	40%	15%
40-mesh	45%	20%	25%
10-mesh	30%	40%	60%

In Fig. 5 we see the relative responsiveness of these three sands to reduction of voids by the addition of filler, and we note that the coarsest sand is productive of lowest voids as is characteristic of such sands, although not enough lower to be of any great consequence so far as final mixture is concerned unless it is also as workable and compressible and develops unusual stability. We are then confronted with two very important considerations; the relative stability, and compressibility of these three sands when in final composition.

In studying the behavior of mixtures employing these three sands, we first design them according to the voidage principle, and, since the amount of final voids is controlled by the filler-content, we plot stability (shear strength at 140 deg. F.) against per cent of filler in the mixture; each separate mixture containing the amount of bitumen required to fill voids in the dry aggregate; the same bitumen (40 penetration Mexican) being used in all.

While the coarsest sand gives the highest strength, you will note (Fig. 6) that the difference between the three sands is not phenomenal since they are about 10 lb. per square inch apart as a maximum for any given filler-content. Now we come to the next very important question, viz., how do they compare as to compressibility?

Relative Compressibility.—Here we find a pronounced difference, and our "A" sand gives by far the best results (Fig. 7). Knowing no more about the problem, we would be strongly inclined to some similar grading in practice. In fact we have consistently been so inclined right along although we had not previously analyzed the matter so exhaustively.

Having determined the approximate grading of, let us say, a model sand, we now come to the important question of variation in bitumen content, above and below the amount required to fill the voids, both with respect to stability and compressibility. For the sake of a rounded-out investigation, this feature was studied for the two more extreme gradings as well as the "model" sand.

Effect of Varying Bitumen.—In the case of the model sand, we find (Fig. 8) it produces highest strength with bitumen commensurate with voids, and the "dry" mix coming next to it, with the "fat" mix the weakest.

As to compressibility, the dry mix, as might be expected, shows up rather badly in comparison with normal bitumen and likewise the richer mixture (Fig. 9). It is to be expected that a mixture containing bitumen in excess of that actually required to fill voids will be rather easily compressed at high temperatures as such a mixture borders upon (and with enough bitumen becomes) a mastic. But it is clearly evident that such excess of cementing medium materially reduces the stability of the mix. For the model grading, we find that normal bitumen (that amount necessary to fill voids) is just as compressible as the rich mix up to a filler content that would usually be the maximum in regular practice.

Now dealing with a weaker and less compressible original mixture, we find (Fig. 10) that normal bitumen gives lower stability than the lean mix, up to about 25 per cent of filler; but taking it all the way through, shows a little better average value than the slightly leaner mix and is considerably superior to the rich one.

NB: It must be borne in mind that 1 per cent more or less bitumen is really a small amount, and differences shown will naturally be greater for greater variations as has been previously shown by investigations of a somewhat different nature reported by Gene Abson last year.

Now we come to the matter of relative compressibility (Fig. 11) of this mixture which in the first instance was much less compressible than that employing a sand of superior grading; and we find that the normal mixture is considerably less susceptible to compression than the one containing 1 per cent excess of bitumen, and the lean mix with 1 per cent less bitumen is in turn less compressible than the normal one.

Coming now to the third series of mixtures employing a coarse sand which showed the highest stability of the three original mixtures, and compressibility about equal to the "B" mix but much less than the model sand or "A" mixture, we find (Fig. 12) the plus and minus 1 per cent bitumen curves in approximately the same relation to the normal as was true of the "B" series, with an earlier reduction in strength for the lean mixture.

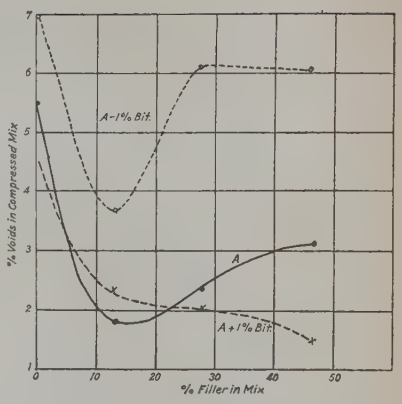

Fig. 9.—Relative Compressibility. Mixture A (Fig. 6) with 1 Per Cent More or Less Than Required Amount of Bitumen

Also we find (Fig. 13) the relative compressibility of the three mixtures about the same as for the "B" series, and it will be recalled that the original "B" and "C" mixtures were quite similar in this respect.

Mixtures from Ideally Graded Materials Most Stable.—From the foregoing, it is clear that certain ratios of sizes in any mineral aggregate are desirable from the standpoint of stability and workability of final mixture. As we have previously pointed out, lowest voids in the sand are not necessarily productive of the best results in the mixture. There is an optimum condi-

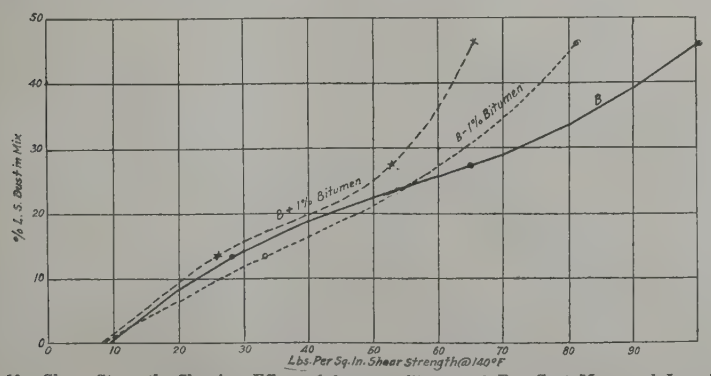

Fig. 10.—Shear Strength, Showing Effect of Varying Bitumen 1 Per Cent More and Less Than Amount Required to Fill Voids in Dry Aggregate

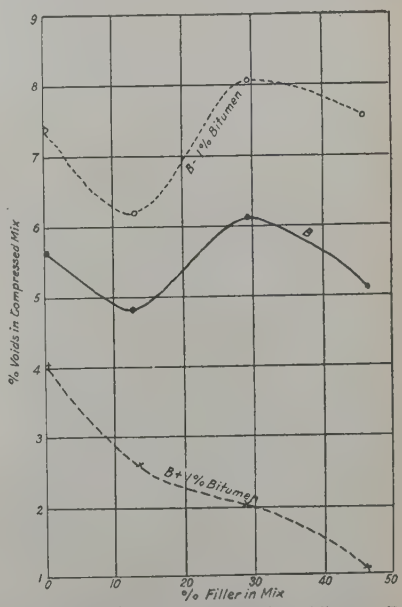

Fig. 11.—Relative Compressibility Mixture B (Fig. 6) with 1 Per Cent More and Less Than Required Amount of Bitumen

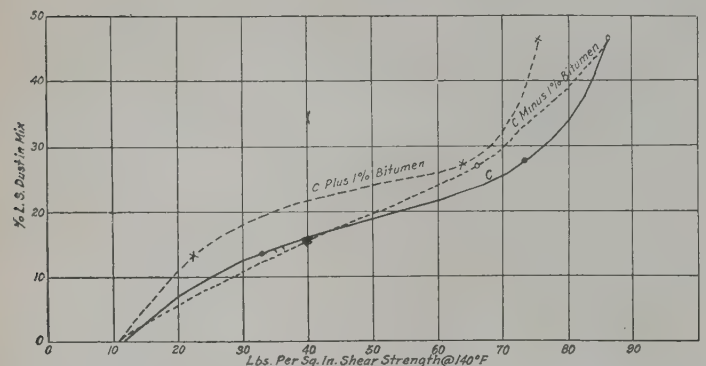

Fig. 12.—Shear Strength, Showing Effect of Varying Bitumen 1 Per Cent More and Less Than Amount Required to Fill Voids in Dry Aggregate, Curve C (Fig. 6)

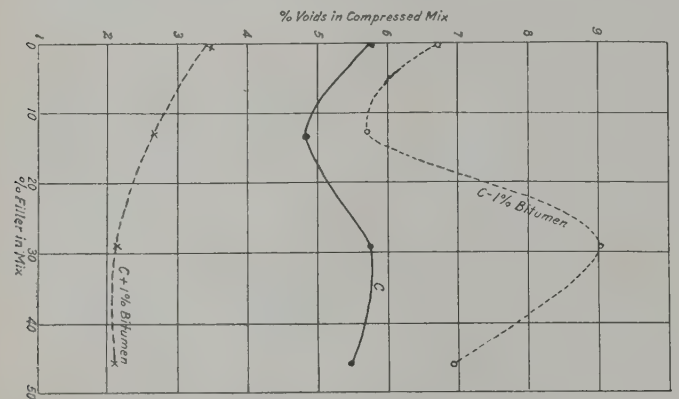

Fig. 13.—Relative Compressibility. Mixture C (Fig. 6) with 1 Per Cent More and Less Than Required Amount of Bitumen

tion, with respect to low voids and final practical considerations. These facts are, of course, not new, but it seems that a rather clear-cut and decisive proof is offered by these studies. Conclusive proof of the undesirability of using very coarse or very fine sands is clearly in evidence here.

The results just discussed appear to us as offering very substantial evidence of the correctness and practicability of the voidage basis of design of mixtures as well as the great usefulness of shear strength (simple shear) as a means of laboratory investigation of mixtures and materials and practical control. It seems perfectly obvious that this rational method of design is based upon data that clearly points out weaknesses in mineral structures of inferior grading, and shows conclusively that when paving mixtures employ what may be termed ideally graded materials, these mixtures are not only most stable but also most workable and most susceptible to compression, when the amount of bitumen present fills or just about fills the voids in the mineral. Previous researches reported by us have also pointed in the same direction, and further work is constantly developing new data that strengthen previous conclusions.

All mixtures were made under standardized laboratory procedure employing heated steel molds, with 2 in. cylinders molded at 350 deg. F. under a load of 5,000 lb. per square inch vertical pressure applied on a hydraulic press, and pressure released immediately. Shear tests were all made at 140 deg. F. in water-bath, shearing load being applied at the rate of 2 lb. per square inch per second. The consistency of results, smoothness of curves, etc., indicate that the entire procedure as to determining voids and testing mixtures is thoroughly developed.

Resident Engineers' Camps

From the Construction Manual of the State Highway Department of Minnesota

The location of an engineer's camp should be as near the middle of the project as practical. This will keep the auto mileage at a minimum. In most cases it is well to be on the detour of the project. Camp should be located near available telephone service. Install one in camp, if possible.

When locating a camp on private property a written agreement shall be entered into with the property owner covering the amount of rental and the removal of temporary buildings, constructed for the camp, at the termination of the agreement.

Vacant buildings are sometimes available, otherwise, 14 ft. by 16 ft. tents are satisfactory. Three such tents with 5 ft. side walls make sufficient housing for a seven-man party. One tent can be used for an office and sleeping quarters for the resident engineer and instrument man. Another will house from four to seven men. The third tent will be the kitchen and cook's quarters. These tents should be framed, floored and walled up, about 18 in. around the bottom.

In some cases a sand point can be sunk where wells are not available.

An ice box, 2 by 2 by 4 ft., with tight cover, can be sunk in the ground, handy to the kitchen. This should be in the shade. A 200 lb. piece of ice will last four or five days.

At the beginning of the job, a requisition of canned goods and other staple groceries sufficient for two months should be sent to the central office. Minor articles and fresh meats should be purchased locally, bills being submitted monthly.

A boarding house statement should be prepared at the end of each month. This statement shall show the exact cost of each meal served and should be prepared similar to the following report:

BOARDING HOUSE STATEMENT,

ENGRS. CAMP S. P.....

Covering Period.....to.....19.....

Inventory of supplies on hand last report....$
Groceries received during this period.....
Vegetables received during this period.....
Fresh meats received during this period.....
Ham and bacon received during this period
Butter received during this period.....
Eggs received during this period.....
Miscellaneous received during this period....
Fuel received during this period.....
Ice received during this period.....
Freight, express and parcel post.....

TOTAL .....$
Cook's salary .....$

Total .....$
Inventory of supplies on hand this date.....$
Total cost of meals.....$
Number of meals served crew.....
Cook's meals .....
Complimentary meals (visitors, etc.).....

Total number of meals served.....
Average cost per meal.....

Depreciation on equipment.....
Total cost per meal.....$
Signed.....

Res. Engineer.

A camp is the home of a party for several months and should at all times be neat, clean and sanitary. Old clothes, boxes and debris should be burned. Beds should be made up when arising and blankets aired and sunned at intervals.

A sanitary outhouse and covered garbage hole should be constructed back of camp. Lime should be used in both at frequent intervals. This is required by law.

When camp is abandoned, the whole camp site should be cleaned up. The outhouse and everything left behind should be burned and disposed of.

Road Signs Advertise City

Findlay Chamber of Commerce, Findlay, Ohio, has installed a series of signs on highways leading into the city. The signs advertise the city's advantages as an industrial center.

Water Purification and Softening Plant at Piqua, O.

Description and Operating Results Given at Ohio Water Purification Conference

By J. M. MONTGOMERY
Superintendent of Water Works, Piqua, O.

PIQUA is located in Miami County on Miami River. Its population in 1920 was 15,044. Previous to June, 1924, the public water supply was obtained from the hydraulic canal which was supplied with water by three small lakes and the Miami and Erie Canal. In June, 1924, a flood occurred which washed out the banks of the hydraulic canal and cut off the water supply of the city. An emergency pumping station was then installed, the pumps taking suction directly from Miami River; the water was chlorinated and pumped to the consumers. Previous to the installation of the filtration plant, the water was not of satisfactory quality and was not generally used in the city for domestic purposes. The existing water purification and softening plant was constructed during 1925 and 1926 following an order from the State Department of Health to provide a satisfactory water supply for the city. It was put into operation in March, 1926.

Source of Supply.—The water supply is ordinarily obtained from Swift Run Lake, one of the series of lakes along the hydraulic canal; water flows by gravity from the lake to the filtration plant. Provision is made for drawing water from Miami River by a low lift pumping station equipped with two 3 mgd. pumps. The low lift pumps discharge either to Swift Run Lake or to the filtration plant. The water entering the plant is measured by a venturi meter and the amount is controlled by a hydraulic valve operated by a float in the settling basin.

Aerators.—The water is aerated through a system of 48 Sacramento nozzles spaced 9 ft. center to center on the roof of the settling basins and carbonation chambers. The water from the aerators passes to the mixing tanks. Piping arrangement permits the aerators to be by-passed.

Chemical Feed Devices.—Alum is fed into the water by means of two "Gauntt" dry feed machines. Each feeder is equipped with a dissolver and the dissolved alum is piped to the point where the raw water enters the mixing tanks.

The lime is stored in two steel bins. Immediately under these bins are two 2,000-lb. weigh hoppers hung on Toledo scales. The weigh hoppers discharge into the lime feeders. The lime is first weighed and then fed into a slaker by means of a "Browning" feeder. This feeder was developed by Oren Browning, the chief operator of the Piqua plant. It consists of a horizontal cylinder and a piston with adjustable stroke. Lime drops into the cylinder through an opening in the top and the piston discharges it into the slaker through an opening in the bottom.

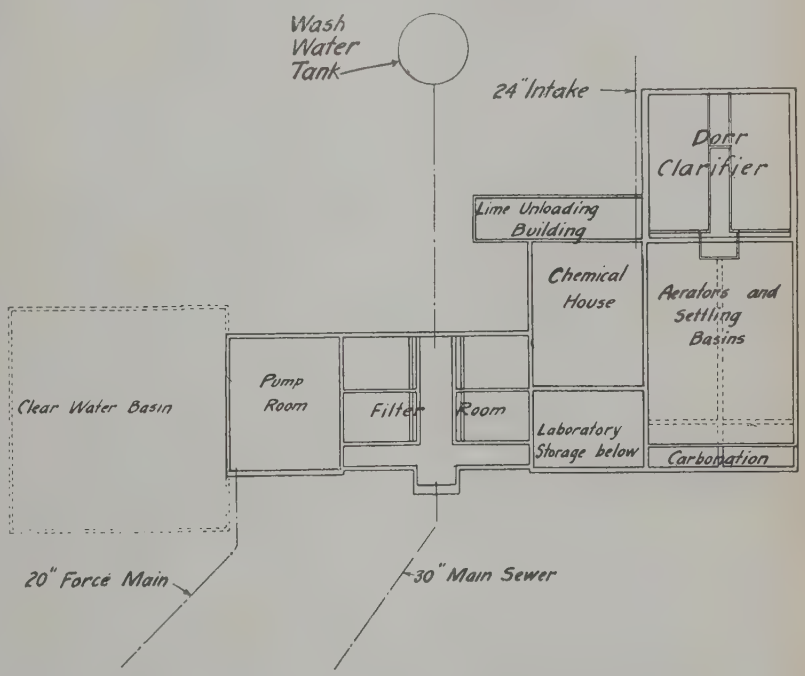

Fig. 1—General Plan of Piqua Water Purification and Softening Plant

From the slaker, the lime solution is piped to the point where the raw water enters the mixing tanks. The feeder is an integral part of the slaker.

The Browning feeder gives a very regular and uniform application of lime. Once set it requires very little attention except for an occasional cleaning. The scales provide an additional check by showing the operator how much lime has been fed in any given length of time.

Mixing Tanks.—There are two steel, circular, mechanical mixing tanks designed for operation singly, in parallel, or in series. The tanks are 21 ft. in diameter with an effective water depth of 22 ft., a total capacity of 114,000 gal. and a detention period of 33 minutes at the rated capacity of the plant—5 mgd.

Mixing is effected by a propeller at the bottom which rotates around a central shaft. Additional mixing is effected by a vertical baffle on the side of the tank. The propellers are rotated so as to produce a velocity of 1.1 ft. per second.

Dorr Clarifier.—From the mixing tanks the water passes through a concrete channel to the Dorr clarifier. The clarifier is 50 ft. square with an effective depth of 14.9 ft. providing a capacity of 280,000 gal., a detention period of one hour and 20 minutes and a velocity of 0.53 ft. per minute at the rated capacity of the plant. The water enters the basin through twenty 10-in. holes in the bottom of the inlet trough. Directly under these holes there is a wooden baffle bracketed out from the wall which effectively kills the entrance velocity. The water leaves the clarifier over a weir which extends entirely across the basin. Sludge removal devices are standard Dorr equipment, the sludge being pumped by a Dorrco pump.

Settling Basins.—There are two settling basins arranged for operation in parallel only. Each basin is 24.88x61.83 ft. in plan with an effective depth of

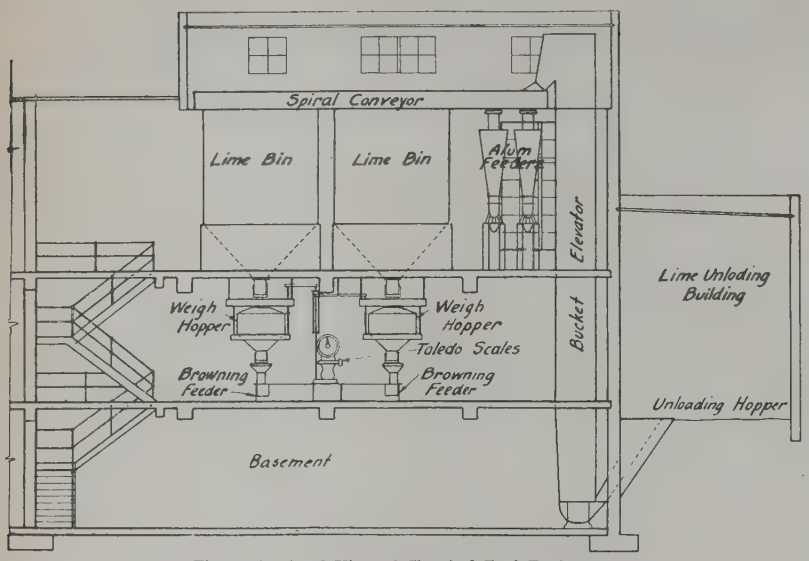

Fig. 2—Sectional View of Chemical Feed Equipment

18.5 ft. The total capacity of the two basins is 425,000 gal., which provides a detention period of two hours and a velocity of 0.5 ft. per minute at the rated capacity of the plant. The water enters each basin through twelve 6-in. square openings in the bottom of the inlet channel and the outlet to the carbonating chamber is through 6-in. square openings 3 ft. below the flow line in the wall separating the settling basin from the carbonation chamber. Each basin drains to a central channel which slopes to the inlet end where the sludge is withdrawn through a sluice gate.

Carbonation Chambers.—The carbonating chambers are located adjacent to the settling basins. Each basin is 24.88x14.75 ft. in plan with an effective depth of 18 ft. The total capacity of the two basins is 99,000 gal., which provides a detention period of 28 minutes at the rated capacity of the plant. The water flows under a vertical baffle and flows out through an outlet chamber controlled by 2x8-ft. stop plates. The carbon dioxide distributing system consists of a grid of ¾-in. pipes on the bottom of the tank, which pipes are perforated on the bottom with $\frac{3}{16}$-in. holes spaced 12 in. center to center. The carbon dioxide generating equipment consists of a combined coke burner and scrubber, and a compressor driven by a variable speed motor.

Filters.—There are four filters, each with a rated capacity of 1.25 mgd. Each unit is 18x24 ft. in plan with a total length of 8 ft. Each filter is provided with three cast iron wash water troughs of adequate capacity for a 24-in. rate of wash. The filtering material consists of 26 in. of sand supported on a 2-in. layer of torpedo sand and 5 layers of gravel.

The filter underdrains consist of 3-in. laterals spaced on 12-in. centers connected through 4-in. risers to a 2-ft. square concrete manifold beneath the filter. Filter equipment consists of Simplex controllers, rate of flow and loss of head gages. All valves are hydraulic valves controlled from operating tables.

Wash Water Facilities.—A wash water tank having a capacity of 30,000 gal. is located west of the filters. This capacity provides for one 5-minute wash of one filter at a rate of 24-in. vertical rise. The wash water tank is filled from the high service mains through an automatic valve.

Clear Well.—Located south of the pump room is the clear well, 75 ft. square with an effective depth of 12 ft. Its capacity is 500,000 gal., which provides a storage period of 2.4 hours at the rated capacity of the plant. The clear well is covered with a concrete roof, on which there is an 18-in. earth fill.

Disinfection.—Chlorine is applied to the filtered water in the main effluent line leading from the filters to the clear well. A pedestal type W. & T. chlorinator is located at the west end of the filter operating floor.

Operating Results.—All of the equipment at the Piqua plant is working out very satisfactorily. The percentage removal of sludge by the Dorr clarifier has been made a routine test. To date the average has been 97 per cent, with a minimum of 94.5 per cent and a maximum of 99.6 per cent. Very little is left for the settling basins to take out. They have been washed out but twice since the plant was put into operation 18 months ago. In the operation of the clarifier approximately 0.75 per cent of the total water taken into the plant is wasted in removing the sludge.

The filters are being run at a rate of 150 million gallons per acre per day. At this high rate the filters are averaging 28 hours between washings. The amount of wash water required is 1.7 per cent of the total quantity of water taken into the plant.

Table I shows an average of the chemical results for September, 1927. The results for the treated water appear to be low because these samples are heated to 50° C. before analysis in order to complete the chemical reaction and to give a true indication of the chemical treatment.

The exceptionally low alkalinities obtained in the filtered water are due to a new method of treatment which has been worked out and put into effect. The rest of this paper will be devoted to an explanation of this treatment.

Carbonate hardness cannot be reduced to zero by treatment with lime because the calcium carbonate formed by the addition of lime is soluble to the extent of about 17 parts per million. This figure is the ultimate limit toward which the lime softening plant can work.

In actual practice in the past, the limit to which carbonate hardness could be removed was much higher than 17 parts per million. The limited results that could be obtained were due to the presence of magnesium in the raw

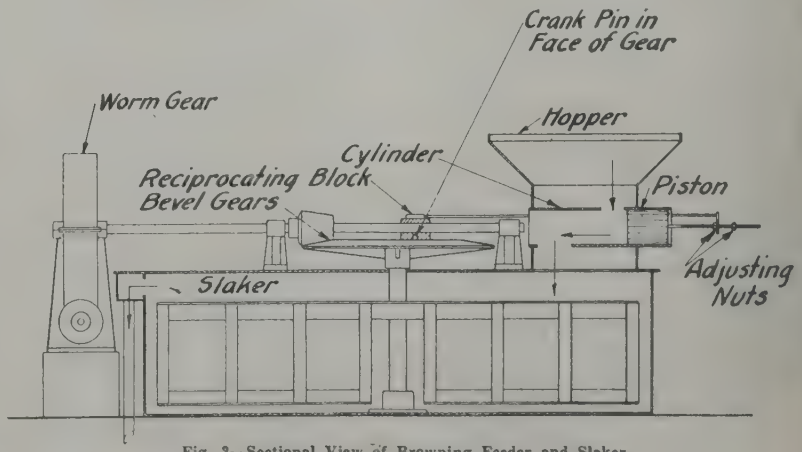

Fig. 3—Sectional View of Browning Feeder and Slaker

water and to the formation during the softening reaction of complex magnesium compounds which were soluble in water. These compounds, according to Hoover, have the following formula:

$Mg_4 (OH)_2 (CO_2)_3$
$MgCO_3 NaHCO_3 4H_2O$
$MgCO_3 NaCO_3$

These basic carbonates are most likely to be formed when soda ash is used along with lime in the treatment of the water, but they are also formed when lime alone is used if the raw water contains magnesium carbonate.

A great deal of work has been done, and a number of papers have been written on how to lower the limit to which carbonate hardness can be removed by lime treatment. It is possible to add an excess of lime and in this way precipitate practically all of the magnesium. The excess lime is then neutralized with soda ash, leaving free sodium hydroxide in the water. This treatment is both expensive due to the use of soda ash and objectionable due to the free sodium hydroxide. Split treatment, which consists of mixing all of the chemicals required with a part of the water and subsequent mixing with the rest of the water, is helpful but does not greatly lower the point to which the carbonate hardness can be reduced. Compounds of aluminum are also helpful under certain conditions, but they, too, are expensive.

Another method has been made possible by the installation of carbonation equipment in connection with lime-soda water softening plants, namely—overtreatment with lime followed by recarbonation. This treatment has been used at Piqua since the middle of June of this year.

At the time that the carbonation plant at Piqua was first put into operation, considerable difficulty was being experienced in regulating the lime feed. At times the water would be overtreated and at other times undertreated. During this time, beginning in August, 1926, a great number of freak results were obtained which were difficult to account for. At times the alkalinity of the filtered water would be as low as 18 parts per million.

A study of the daily analytical sheets showed that these low alkalinities always followed a period of high overtreatment with lime followed by recarbonation to the point where the total alkalinity minus two times the phenolphthalein alkalinity equalled approximately 5. The following is a typical example.

Total Alkalinity (M. O.) 23
Phenol Alkalinity (Ph.) 9
23—(2x9)=5

At that time it was impossible to get these results consistently because of the difficulties with the lime feed.

J. R. Baylis early in 1927 obtained similar results in his laboratory. He overtreated water until he had a caustic alkalinity of 110 parts per million and then recarbonated. The resulting water showed a carbonate alkalinity of only 30 parts per million.

Mr. Hoover in one of his papers has also mentioned overtreatment with lime followed by carbonation as a method of reducing carbonate hardness.

Early in the summer of 1927 Browning dry feed machines for lime were put into operation at Piqua. These machines gave a very accurate feed and it was then possible to try to duplicate consistently the freak results obtained before. In Fig. 5 will be found Curve I, showing the alkalinity of the filtered water during a typical month under the old treatment. Curve II shows the alkalinity of the filtered water during the month of September, 1927, as a result of the new treatment.

It was found that for the Piqua water it was necessary to add lime in excess and to the extent of obtaining 40 parts

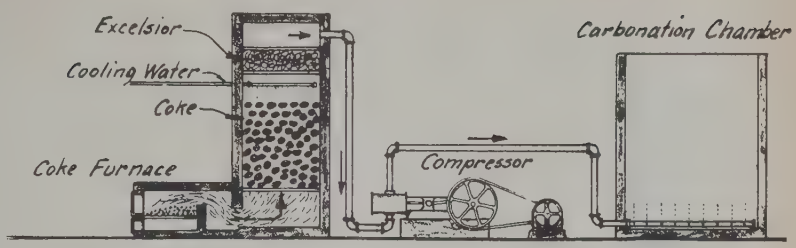

Fig. 4—Sectional View of Carbonation Plant

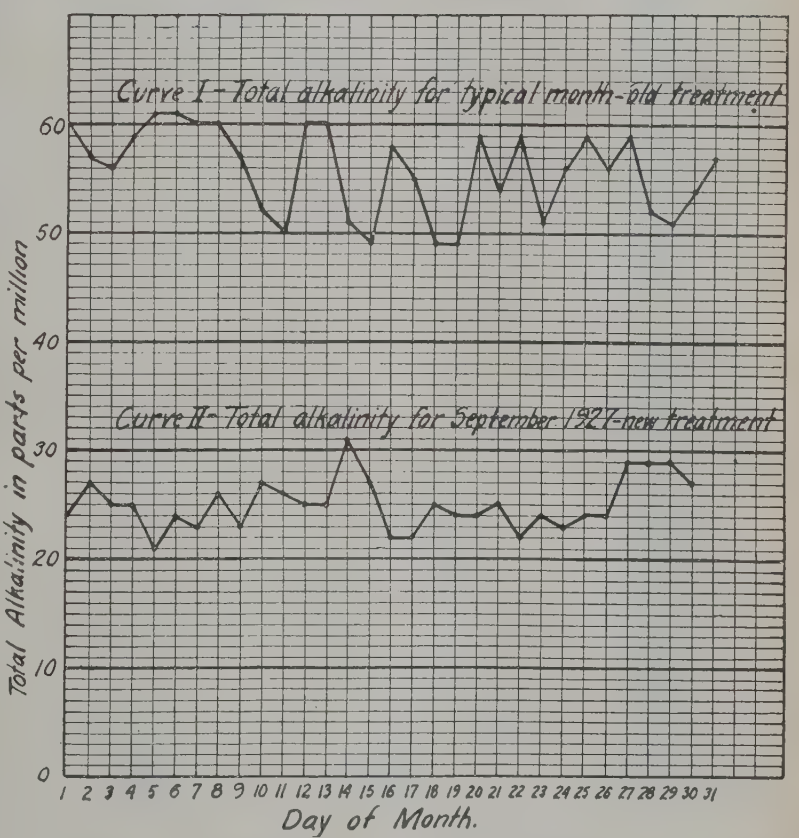
Curve I - Total alkalinity for typical month-old treatment
Curve II - Total alkalinity for September 1927-new treatment
Total Alkalinity in parts per million
0
10
20
30
40
50
60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month.

Fig. 5—Total Alkalinity of Filtered Water Compared for Typical Months Under Old and New Methods of Treatment During 1927 at Piqua

Table I—Average Results of Chemical Analyses During September, 1927, for Water Before and After Treatment at Piqua Water Softening Plant

	Raw Water	Treated Water	Settled Water	Carbonated Water	Filtered Water
Total Alkalinity	228	73	88	50	24
Basicity	.....	32	26	43	20
Causticity	.....	41	58	....	....
Incrustants	32	32	31	31	32
Total Hardness	260	105	119	81	56
Magnesium	25	.....	.....	....	5

Sample heated to 50° C. before analysis.

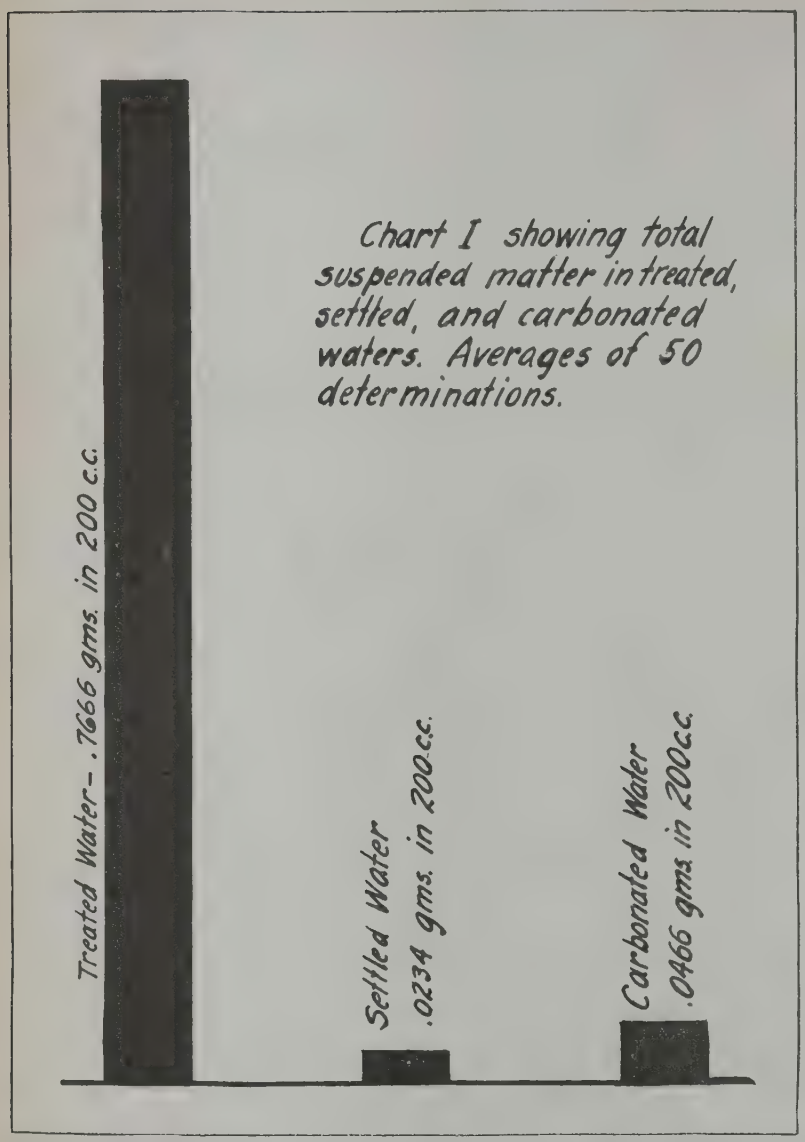
Chart I showing total suspended matter in treated, settled, and carbonated waters. Averages of 50 determinations.
Treated Water - .7666 gms. in 200 c.c.
Settled Water .0234 gms. in 200 c.c.
Carbonated Water .0466 gms. in 200 c.c.

Fig. 6—Total Suspended Matter Compared for Softened Water Before and After Carbonation Using New Method of Treatment at Piqua

per million causticity. Any less than this amount gives correspondingly higher alkalinities in the filtered water. Any more than this amount is unnecessary. The water is then recarbonated to the point where the total alkalinity minus two times the phenolphthalein alkalinity equals approximately 5. After passing the filters the water then has a total alkalinity of 20 to 25 parts per million, consisting of 15 to 20 parts per million of normal carbonates and 5 parts per million of bicarbonates.

Very strict regulation of both the lime and carbon dioxide feed is required to produce these results. The treated water at Piqua must have at least 40 parts per million of caustic alkalinity and any slight deviation from the required amount of carbon dioxide will make a great difference in the finished product. The total alkalinity minus two times the phenolphthalein alkalinity must be very close to 5.

The chemistry of this treatment is assumed to be as follows. Due to the heavy overtreatment with lime practically all of the magnesium is precipitated in the form of flocculent magnesium hydrate. When the magnesium has been precipitated, the chief obstacle in water softening has been removed. The alkalinity due to calcium carbonate is very readily reduced. In the carbonation process the excess lime or free calcium hydroxide is precipitated as calcium carbonate, which is removed by the filters. Quantitative determinations made every day for a period of 50 days show that there is twice as much suspended matter in the carbonated water as there is in the settled water. Chart No. 1 in Fig. 6 is made from the averages of 50 daily determinations and shows graphically the quantities of suspended matter in the treated, settled and filtered waters.

Water treated by this process will, possibly, cause incrustation of the sand in the filters, but the filtered water is so close to the theoretical solubility of calcium carbonate that it gives no indication of causing any deposit whatsoever.

Fig. 7 was prepared by Mr. Baylis and shows the relation between hydrogenion concentration, total alkalinity and the incrusting properties of waters. The curve shows that if a water has an alkalinity of 24 it can have a pH of 9.6 and will not cause incrustation. The water at Piqua has an average alkalinity of 24 and a pH of 9.1, therefore it should not form any deposition whatsoever after it has passed the filters.

The extra softening provided by this method of treatment costs but slightly more than the ordinary lime softening process. It has been customary in lime softening plants to carry about 5 parts per million of caustic alkalinity in the treated water. The new treatment requires 35 parts per million in addition to this amount. Thirty-five parts per million of caustic alkalinity is equivalent to 20 parts per million of 100 per cent CaO. This in turn is equivalent to 140 lb. of 100 per cent lime to remove approximately 30 parts per million of hardness from the million gallons of water. If 100 per cent lime costs $10 per ton, this is a cost of 2.5 ct. per part per million, per million gallons of water treated. The cost of ordinary lime treatment at Piqua with 100 per cent lime at $10 per ton is 4.0 ct. per part per million, per million gallons. The cost of soda ash treatment, with soda ash at $30 per ton, is 12.0 ct. per part per million, per million gallons.

If this process does cause incrustation of the filter sand, the cost of replacing the sand must be added to the extra cost for lime. The filter sand might be considered as a softening agent. The filters at Piqua contain 130 cu. yd. of sand. At $5 per yard it would cost $650 to completely replace the sand. If the sand had to be replaced in 10 years the cost would be $65 per year to remove approximately 30 parts per million of hardness. At the present rate of consumption this is equivalent to a cost of 0.36 ct. per part per million, per million gallons of water treated. The cost of lime (2.5 ct. per part per million) plus the cost of sand (0.36 ct. per part per million) makes 2.86 ct. per part per million, per million gallons. The additional 30 ppm. of hardness which is removed by this method is removed more cheaply proportionally than the other 170 ppm. of hardness.

The amount of carbon dioxide used is about the same as is used for regular

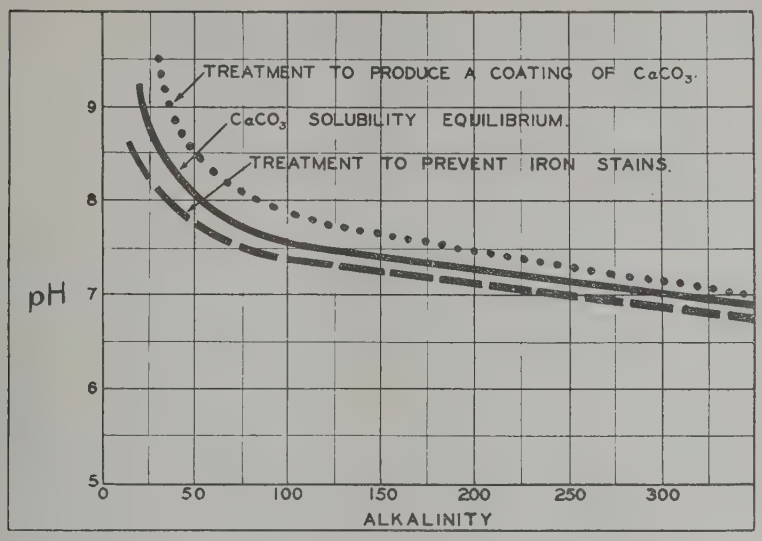

Fig. 7—Relation of pH and Alkalinity to the Proper Treatment of Water to Prevent Corrosion

lime treatment. The new treatment uses only enough carbon dioxide to convert the caustic alkalinity to normal carbonate alkalinity and crystaline calcium carbonate. The regular treatment uses the carbon dioxide to convert the caustic and normal carbonate alkalinities to bicarbonate alkalinity. The quantity of carbon dioxide required for each method of treatment is about the same.

The total hardness of the filtered water is averaging about 50 to 55 parts per million without the use of soda ash. Without the new method of treatment the total hardness would be 80 to 85 parts per million. The additional softening is greatly appreciated by the consumer.

Sewage Disposal Improvement at Columbus, O.

The city of Columbus is ready to start on its large program of sewage disposal improvement, according to "Ohio Health News" of July 15. General plans of the Olentangy-Scioto intercepting sewer were approved in June. The construction of this new interceptor is the first step in improvement of the sewage collection system for the city, to be followed by improvements in pumping facilities and sewage treatment. The city is under order of the State Department of Health to install the necessary improvements to correct the pollution of the Scioto river and Alum creek.

The new interceptor is liberally designed in the effort to reduce pollution due to overflows to the river from the combined sewer system to a definite minimum. It is estimated that only four overflows a year will occur in the downtown section, and eight in the upper section of the new sewer, and those of course, will be at times of severe rains and high stages of the river. The flow in an intercepting sewer of the size planned will naturally frequently exceed the capacity of the proposed enlarged sewage treatment plant. This is to be cared for by the construction of so-called storm standby tanks which will accomplish two things. (1) storage of light storm flows, with subsequent discharge to plant, and (2) sedimentation of heavier and more prolonged storm flows. This feature is an innovation in Ohio and so far as known in the United States, although more or less common in some of the European countries, particularly England.

The new work is being carried on by the office of the city engineer. The personnel of that department has been enlarged; Orris Bonney is in charge of new sewerage, and Robert Allton in charge of sewage disposal design. John W. Gregory, Baltimore, as consulting engineer, has general supervision of the improvements.

Condition of Filter Sand After 17 Years' Use

The filtration plant of Bangor, Me., has been in operation for over 17 years. During 1927 the sand was removed and the laterals and strainers cleaned in all of the units. The following note regarding the sand is extracted from the report for 1927 of James M. Caird, Chemist and Bacteriologist of the plant: "When the sand was placed in the filters 17 years ago it had an effective size of .44 mm and a uniformity coefficient of 1.50. During the washing of the filters some of the finer sand was lost, so that at the end of 13 years the sand had an effective size of .72 mm and a uniformity coefficient of 1.66. During the past year some fine sand has been added to the filters to take the place of that lost during washings."

Canadian Cities' Architecture Control

Canadian cities and rural provinces are applying the principle that there are amenities in architecture, and that violation of them are an offense which the community has the legal right to prohibit.

Complete control over the architecture as well as over the location and height of buildings, public and private, to be erected in the city of Quebec is given to the new Quebec Town Planning Commission created by a far-reaching provincial bill which has just been passed.

The commission is given not only the right to pass on proposed structures from the standpoint of neighborhood architectural harmony, but is also given full power to replan those parts of the city that have suffered from what has been characterized as "building anarchy."

The city of Ottawa has also applied for and received right to exercise architectural control over certain proposed new developments. The province of Alberta in a new town planning act has authorized a permanent provincial town planning board, one duty of which shall be to "assist and advise any rural authority in devising ways and means of preserving the natural beauty of the locality and insuring that new buildings and erections therein shall be so designed and located as not to mar the amenities of the locality." It takes definite cognizance of buildings located on any highway to which the act applies, making regulations as to their design and construction.

California cities are given the power to control the architecture of private structures planned to be erected within their boundaries under the wording of the state's planning act of 1927, and in some instances they are already exercising such powers, the National Association of Real Estate Boards points out.

Great Britain has a town planning act which gives power to a local authority to prescribe the character of buildings. A number of cities, notably Edinburgh and Bath, have interpreted the clause to mean community control over the design of buildings as well as over suitability of their location.

Fort Worth, Tex., to Advertise

Inauguration of a Department of Publicity at Fort Worth, Tex., with expectation of eventually entering the list of community advertisers, has been announcd by the Fort Worth Association of Commerce. The new department is in charge of Ed. F. Flannery, former Florida newspaperman. For the present the department will devote much time to plans for a future advertising fund for the city.

Recent Studies at Houston Activated Sludge Plant

Notes on the Disposal of Sludge

By G. L. FUGATE AND W. S. STANLEY
Assistant City Engineer, Chemist, Houston, Tex.

UP to 1920 the only means of excess sludge disposal at Houston, Texas, was lagooning.

It has been repeatedly observed that when pH of sludge in lagoons falls below 7.0 a thick crust of undigested solids forms on the surface of the lagoons, accompanied by a highly offensive odor. This can be remedied in mild cases by hosing the lagoon with fire hose. Aggravated cases were known to persist for 10 days or more, and were alleviated only by persistent stirring and hosing. The addition of lime would doubtless help, but the cost of such procedure makes its use out of the question.

Lagooning Not Practicable.—From the above it is apparent that lagooning is not practicable in Houston, especially if we consider the highly putrescent effluent of 900 p.p.m. B.O.D., which has to be either discharged directly into Buffalo Bayou or retreated in the plant. The last recourse would put an undue load on the activated sludge plant, whereas the first would contribute excessively to the pollution of this navigable stream.

It therefore became necessary to turn toward a method free of those objectionable features. Such a method was thought to be filtration, yielding stable effluent and salable solid material.

Consequently a dewatering plant was built and put in operation in January, 1921. This plant consisted of three cypress sludge settling tanks of 50,000-gal. capacity each, two plate and frame presses and one direct indirect heat Buckeye dryer.

The performance of the dryer was quite satisfactory, but the filter presses proved very expensive to operate. After a year of use they were discarded and a standard wet machine used in paper pulp industry installed. This machine was quite an improvement over the plate and frame presses, but due to high cost of blanket roll was replaced by a modified "Decker" type machine. The conditioning agent used for plate and frame presses was mostly sulphuric acid and with "Decker" sulphur dioxide gas.

The pulp machines showed an excessive loss of suspended solids through the screen which condition, coupled with high cost of replacements to wire screen and felt blankets caused abandonment of their use. At the end of July a 4-1 vacuum disc filter was installed and intensive experiments started, which terminated successfully in February, 1926. The filtering installation at the North Side Disposal Plant will consist of sludge conditioning equipment and the filter proper.

Filtering Requirement for the Activated Sludge.—Activated sludge to be successfully filtered must conform to certain requirements:

1. As the sludge will not filter well in its raw state, it must be conditioned by means of some chemical. The conditioner must be added in the right amount to insure proper pH.

2. The sludge must be well aerated. An improperly aerated sludge will not filter well no matter what its conditioning.

3. It must not be septic. The fresher the sludge the less conditioner it requires and the better it filters.

4. There must be as little agitation as possible after addition of conditioner.

To insure freshness, sludge will be brought directly from settling tanks and filtered immediately, without storage.

To insure proper conditioning a sludge feeder of the bucket wheel type and a conditioner solution feeder of the same type will be installed, both operated by the same countershaft, and so arranged that the proportion of conditioner to sludge when once adjusted will not vary, no matter how the speed of filtration varies, unless adjusted again by the attendant.

The pH of conditioned sludge will be checked by both the colorimetric method and by measuring the resistance of sludge as it flows to the filter. In the latter method there will be employed a recording millimeter, which will give continuous and permanent record of the condition of sludge as it enters the filter.

In order to allow the sludge to mix intimately with the conditioner without being violently agitated a long baffle box with alternating over and under baffles will be employed. This will insure a large well formed floc, just such floc as is necessary for best filtration.

The Conditioner.—The selection of the conditioner seems to be one of the most important factors of the whole process of sludge dewatering. Sulphur dioxide gas and sulphuric acid gave indifferent results as far as Houston practice is concerned, while aluminum sulphate and chlorinated copperas are efficient and the choice between the two is only a uqestion of price.

Consequently it was decided to install suitable equipment for chlorinating copperas, as well as storage facilities for handling aluminum sulphate.

The pH at which sludge filters best was fixed as follows:

1. For sulphur dioxide pH between 3.2-3.6.

2. For sulphuric acid pH 3.4.

3. For aluminum sulphate, between pH 4.4 and 4.8 with good results.

4. For chlorinated copperas, pH 5.4 seems to be the point at which consistent good results were obtained.

It was found that a high pH "mudding" of the cloth occurred. This is caused by the wet sludge smearing over the surface of the cloth and stopping filtration. On the other hand low pH causes "white spotting." This is a peculiar condition of cloth where conditioner used acts as a mordant and fixes certain colloidal substances in the pores of the cloth, thus checking the rate of filtration. Both conditions are quite detrimental to the successful operation of the filter and should be guarded against.

The speed of the filter depends upon the condition of sludge. The best results were obtained in Houston at a speed of one revolution per 12 minutes.

The kind of cloth to use for filtering medium has not yet been determined. We have used palma twill and burlap cloth with equal success as far as the rate of filtration is concerned. The wearing quality of palma twill is the only argument in its favor. Woolen blanket cloth will also be considered.

The drying of cake obtained by filtration did not present serious difficulties when the moisture was kept below 85 per cent. There was, therefore, no reason for immediate research in this direction. All energy was centered upon the filtration problem. This being successfully solved, the next step will be the study of drying conditions. With this in mind, a recording pyrometer and a recording hygrometer are going to be installed to study and record both the temperature in the dryer and the humidity in exhaust gases.

Acknowledgment.—The foregoing is a paper presented at the 10th Texas Water Works Short School.

Tree Planting for Parks and Streets

Some Notes on Practice in England

By W. DALLIMORE
Keeper of Museums, Royal Botanic Gardens, Kew

THE selection, planting and care of trees in public parks and open spaces, and in streets and roads, present some of the most difficult problems that confront arboriculturists. Under the best possible conditions, problems in culture and administration are liable to arise that are unsuspected when cultural activities are confined to private grounds, and even the enthusiasm of tree-loving residents may become embarassing to municipal officials if their enthusiasm is not leavened with knowledge and caution.

Young Trees.—The production of trees suitable for planting in streets and roads is a costly undertaking. Nurserymen have them on their hands five to ten years, throughout which time they must be transplanted regularly, pruned and carefully cultivated. Few nurserymen are in a position to take large risks, but if a definite demand were made, and nurserymen were assured that certain trees in large numbers would be required by a given year they would be only too happy to produce them.

Whenever possible it is wise to raise trees from seeds. This can be done with many species, but species that do not seed freely, hybrids and varieties, must be raised by other means—cuttings, layers, grafting or budding. Grafted trees are usually less reliable for exposed positions than those raised from seeds, cuttings or layers. At the end of the first year they are planted in nursery lines, care being taken to reject weaklings and diseased and deformed plants. From this time onwards attention is directed towards the production of a uniform root system with a good provision of fibrous, feeding roots, and the development of a stout single trunk with short side branches bearing ample, healthy leaves.

Trees may be left in nurseries until they are 16 or 18 ft. high, but it is not always wise to allow them to remain so long, and sturdy trees 10 to 14 ft. high are usually more satisfactory than larger ones. In fact, for park planting, trees 6 to 8 ft. high are large enough, and the earlier in life they can be transferred to permanent places the better it is for the trees.

General Park Planting.—Trees may be required to form avenues, groups or isolated specimens. Except for groups, general trenching of the ground is out of the question, but large holes should be excavated for the trees. Generally, the poorer or harder the soil the larger should be the holes, but for permanent trees no hole should be less than 4 ft. in diameter in the best ground, and in poor soil be dug 2 ft. deep and the bottom be well broken up. Should permanent water be found at that depth ground drainage is necessary. Very poor soil should be removed and replaced by better material, and soil from near the surface of the ground must be kept for placing about the roots of the trees.

As soon as dug the holes may be filled to within 9 or 12 in. of the surface, taking care to tread the soil firm. The holes should then be allowed to settle for a few weeks before planting. At planting time any injured roots must be cut clean and the roots spread out to their fullest extent, taking care to work fine soil in amongst them and to well firm the soil.

The depth of planting is very important. It is necessary that the upper roots should be kept near the surface of the soil, and a rod placed across the top of the hole, resting on the natural soil level at each side, gives a guide to planting depth. Deeply planted trees rarely give such good results as those where the upper roots are kept near the surface of the ground. A good watering after planting helps to settle the soil about the roots. Trees with moderately heavy heads may require staking until such times as they are well established, but stakes should not be used when the trees appear to be standing firm. Watering in dry weather may be necessary during the first year or two after planting, and a mulch of decayed manure and leaves placed above the roots will help in establishing the trees.

When selecting positions for trees consideration should be given to their size at maturity and space allowed for their proper development. Spacing which appears absurdly wide at planting time may give trees so little room as to result in crowding 25 years later, a time when it may be impossible to give more space. Should a temporary furnished effect be desired, permanent trees should be given proper space and be interplanted with nurse trees which can be removed later on. Avenues are often made too narrow, and the trees planted too close together in the rows through not taking into account the average size of the trees at maturity.

The judicious use of trees of varying habit, such as round-headed, pyramidal, weeping-branched trees, and so on, should be considered in the layout of a park, for one helps the other in the general effect; also the selection of vantage points for those of particular merit, either as isolated specimens or groups, should receive careful attention, and the provision of a dark background and special shelter for those that flower very early in the year in advance of leafage is an advantage.

Widely spaced trees are liable to develop laterally at the expense of height, and this tendency must be corrected by pruning. Shortening and the removal of branches must be carried out with care, clean cuts must be made parallel with the bark of the main branch or trunk, leaving no vestige of a snag, and the wounds must be dressed with coal tar or some other antiseptic dressing as soon as made.

Small open spaces are often more difficult to deal with than parks. Some are better adapted for flower gardening than for trees, but there are others where trees and shrubs are undoubtedly the proper things to plant. In spaces to which the public are admitted shade trees are usually popular.

By all means avoid the more gardeny kinds of shrubs, such as those with variegated leaves, for these positions, and encourage a free system of growth; too often a variety of shrubs are planted in small open spaces and subjected to one or more hard annual clippings, whereas a mass of one suitable freely grown plant would be infinitely more pleasing.

Trees in Streets.—A generation ago municipal authorities employed fewer men trained in tree cultivation than is usual at the present time, but even now there are places where the management of street trees is under the control of people who have had no definite training in question concerning trees and their cultivation. This may be the reason why, upon examining unhealthy trees, it is sometimes found that not only have unsuitable kinds been planted in poor soil, in holes scarcely wide enough for the spread of the roots, and that from 8 to 15 in. of the trunk have been buried.

There are reasons why trees which attain a considerable height should be employed in roads and streets, but it is difficult to understand why such heavily branched and heavy leafed trees as horse chestnut, plane, lime and common elm should have achieved such great popularity, while the infinitely lighter and more graceful silver birch and false acacia have received comparatively little attention. Even in moderately narrow roads widely spaced birch trees

could be allowed to develop to their full size with little pruning other than the removal of lower branches.

Where no definite provision has been made for trees in the original layout of the road they must be placed in the footpaths.

The distance they can be planted from the curb with safety is an important question, probably 18 in. may be regarded as the minimum. Trees planted closer than that are likely to have their trunks injured by wide vehicles or overhanging loads, which may be crowded into the side of the road, and may themselves be sources of danger to traffic. Even at a minimum of 18 in. the trunks will probably be too near the curb at the end of 20 or 25 years' growth. It must also be considered how such trees are likely to interfere with pedestrians, and whether sufficient space for aeration and water can be left uncovered by pavement. Small growing trees would really be better for narrow roads were it not for the difficulty experienced in keeping the branches out of the way of traffic. Trees of narrow, pyramidal, or fastigiate habit are better suited to such positions than trees with spreading branches, but are rather difficult to increase quickly.

Difficulties sometimes arise through the roots of trees lifting the paving stones on the footpaths, and engineers are very anxious to know of trees that do not cause such trouble. I am afraid that they are hard to find. Roots, as they increase in size, must find additional space. There are obstructions all round them, road foundations, cement roads, pipe lines, house foundations, walls and what not. Above them are paving stones; the line of least resistance is taken, and the paving stones are lifted by the growing roots.

Where streets are wider and there is additional footpath space an open area of ground is sometimes left between the curb and pavement for the accommodation of trees. This is in every way an excellent idea, and one to be encouraged. It would even be an advantage in many instances if road engineers would, where space is limited, arrange for a narrow footpath on one side of the street and a wide one on the other, restricting tree planting to the wider side, and perhaps concentrating the various service lines along the other.

Causes of Damage to Street Trees.—Service lines laid near trees have on several occasions been the cause of injury to street trees, more particularly leaking gas mains, and fungus diseases have commenced through injury to roots during repair work. Moreover, trees are made unstable by cutting the roots. The full extent to which trees suffer through these service mains is not understood.

How far modern road construction and surface dressings may affect the health of trees it is difficult to say, but the restriction of the roots by deep cement roads may lead to slow development, and cause the soil to dry rapidly in periods of drought. Tar dressings may adversely affect street trees, although if serious consequences were very likely to result the ill-effects should now be apparent. On the other hand, tar dressings have beneficial results by decreasing dust.

How far leaves and fruit falling on smooth-surfaced roads in wet weather may increase the danger of skidding is problematic; the question might be worthy of consideration. Also whether the pounded-up leaves or fruits of certain kinds of trees would be more dangerous than those of others.

In some instances more attention should be paid to the removal of branches from trees. They are often removed in a careless manner, and in addition to ugly stumps being left, the possibility of the wounds healing is remote. Roadside trees from which branches have been removed on account of traffic, or because they were dangerous, are often left in a very unsightly condition. The filling and cleaning of wounds in trees is another operation that should receive attention. By proper treatment many years may be added to the life of certain kinds of trees.

Acknowledgment.—The above is an abstract of a paper presented June 21 at the annual meeting of the Institute of Municipal and County Engineers of Great Britain.

Essentials of a Good Municipal Report

By C. E. RIDLEY
National Institute of Public Administration

I. Date of Publication.

1. Promptness. The report will have little value unless published soon after the end of the period covered—six weeks as a maximum.

II. Physical Makeup.

2. Size. Convenient for reading and filing, preferably 6 in. by 9 in.

3. Paper and type. Paper should be of a grade and the type of such size and character as to permit easy reading.

4. Important facts. The more important facts should be emphasized by the use of different types of artistic presentation.

5. Attractiveness. The cover, title, introduction, and general appearance should aim to attract the reader and encourage further examination.

III. Content.

A. Illustrative Material.

6. Diagrams and charts. Certain established rules should be followed to insure an accurate and effective presentation.

7. Maps and pictures. A few well chosen maps to indicate certain improvements, and a liberal supply of pictures, if pertinent to the report should be included.

8. Distribution. Great care should be exercised in placing the illustrative material contiguous to the relevant reading material.

B. Composition

9. Table of contents. A short table of contents in the front of the report is a great aid for ready reference.

10. Organization chart. An organization chart or table indicating services rendered by each unit, if placed in front of report, will help the reader to a clearer understanding of what follows.

11. Letter of transmittal. A short letter of transmittal, followed by summary of outstanding accomplishments and recommendations for the future, should come early in the report.

12. Recommendations and accomplishments. A comparison of past recommendations with the progress toward their execution will serve as an index to the year's accomplishment.

13. Length. Fifty pages should be the maximum length.

14. Literary style. The text should be clear and concise, reflecting proper attention to grammar, sentence structure, and diction.

15. Arrangement. The report of the various governmental units should correlate with the organization structure, or follow some other logical arrangement.

16. Balanced context. The material should show a complete picture and each activity should occupy space in proportion to its relative importance.

17. Statistics. Certain statistics must be included, but wherever appropriate, they should be supplemented by simple diagrams or charts.

18. Comparative data. The present year's accomplishment should be compared with those of previous years, but only with full consideration of all factors involved.

19. Financial statements. Three or four financial statements should be included showing amount expended and the means of financing each function and organization unit.

20. Propaganda. It is unethical and poor taste to include material for departmental or personal aggrandizement. Photographs of officials, especially of administrators, do not belong in a public report.

Acknowledgment.—The foregoing is reprinted from the March "National Municipal Review."

City Insures Its Water Mains.—The city of Wilmington, Del., has insured the water mains, which were exposed by the work of the contractors constructing the new bridge over the Brandywine River at 18th St., for $300,000. At the meeting of the Street and Sewer Commission a warrant was ordered drawn for $2,500 as the premium of the policy. The insurance is made payable to the mayor and city council of the City of Wilmington.

How to Beautify Grounds Surrounding a Water Works

Simple Landscaping Principles Outlined at Convention S. W. W. A.

By JAS. D. FOWLER

ONE thing which has been greatly neglected around water works plants is the beautification of the surrounding grounds. It is a thought worthy of consideration by public officials, or any tax-paying citizen.

Why Water Works Grounds Should Be Beautiful.—Water works grounds should be beautified for psychological reasons if for no other. Beautiful things or surroundings suggest purity.

A water works is only one of the several utilities which should be given the beautification treatment such as will be outlined in this paper. Electric light plants, gas plants, ice plants and sewage disposal plants should be given equally as much attention.

The general opinion is, especially in the smaller towns, that to spend money for beautification is a waste of money, that the water will not be made any better thereby and that the revenue of the plant will not be increased. We may have to admit that there is no direct benefit derived but there surely is an indirect benefit. A well cared for and beautified water works plant is sure to be seen by someone and possibly many who in turn will tell others and the result will be advertisement for the town.

It may be that the city officials will say there are no funds for such a purpose, but the real difficulty is with such officials that they have not been able to visualize and see the beauty in nature. It is wonderful and marvelous the progress which has been made in the manufacture and development of machinery but such is as of naught compared with the things of nature. When we see the seed planted in mother earth and it bursts forth into a beautiful flower or shrub then that is something to marvel about. When a little landscaping is done we are getting back closer to nature and the things that are beautiful.

Too often we find that a water works plant, especially those owned by a municipality, it is the business of everybody, hence nobody's business. The writer has observed generally, that privately owned plants are given more attention along beautification lines than are municipal plants.

Chief Operator Not to Blame.—The chief operator of a plant cannot always be blamed for lack of attention along beautification lines and is oftimes not recognized in his effort to accomplish something. When he applies for financial assistance the city council or authorities do not appreciate the value and necessity of such expenditure and he is turned down in his request. This disgusts the operator, he resigns and then is probably replaced by an incompetent man who will not worry them and who can be employed at a modest salary.

One who expects to accomplish something must realize that the road is not always smooth. He must have that sticktoitiveness and educate the public and more particularly the city authorities with whom he has to deal. He can do this by keeping his plant clean and on a small scale begin to beautify the grounds. He can get some of the citizens to visit the plant and appreciate what is being done and from then on enthusiasm and interest will grow and out of town friends will be invited to visit the plant.

Beautification a Separate Problem for Each Plant.—The landscape development is a distinct problem for each individual plant. The ideal way to proceed would be to employ a landscape architect to prepare plans and make suggestions for the improvement. This, of course, would require an outlay of cash and this, as has been pointed out, is very difficult to secure.

Also, as has been said, the work can be begun in a small way. It is not necessary that the entire work be done or anything elaborate be accomplished immediately. If you will stop for a moment and think what small job it would be to smooth off the rough places or slopes and sow some grass seed, or in southern sections, spot a few pieces of bermuda grass, you would not be long in starting a beautification program around your plant. Water is very necessary in an undertaking of this kind, but the subject we are dealing with being water works would indicate that water was no object.

General Pan of Development.—It is well for the operator who determines to accomplish something along this line to have in mind the following principles which will be outlined, and to prepare in his own way a general plan for the development which he can execute from time to time and gradually expand.

The operator should make a rough map showing the relative locations of the various features on the ground. He should secure sufficient information in regard to the levels to properly drain the grounds and, on this plan sketch out the various features to be added with their ultimate position. He should give general consideration to the grading, driveway, walks, shrubbery, planting, and on more elaborate plans, he would probably go into the matter of flower beds, garden furniture, seats and other features.

Driveways and Walks.—In laying out the general plan one of the first questions will be the driveway, provided the grounds are so situated as to require a driveway. The purpose of the driveway is ingress and egress. It should serve its purpose quickly and be as direct as possible; it is not in itself an ornament but is a utility. On large grounds, it may be one of the functions of the driveway to permit passage through the grounds for the purpose of viewing other features more distant. In such case it may be expanded over greater areas.

The width should be ample, but not excessive. The directions should always be simple and apparently direct. Unnecessary curves and turns are only awkward, not beautiful. The driveway should be located so as not to cut up lawn spaces unnecessarily but should be fitted to the topography and gracefully curve around the existing natural features. If there are no existing natural features, it may be necessary to design a planting of trees or shrubbery to give reason for the desired changes in direction. It is not proper to use a small flower bed, or a small architectural object, or other such things as they are too trivial. The driveway should be from 9 to 10 ft. wide for a single drive, and from 16 to 18 ft. wide for a pass drive. A 12-ft. drive should never be used. It is too narrow for two vehicles to pass and unnecessarily wide for one. There is no beauty in paving surfaces; lawns are to be more desired than the barren driveway.

It will probably be unnecessary to speak of drainage, materials for construction and construction features such as excessive grades, etc., but they should be considered, of course, in a practical manner.

Walks and paths are designed and built on the same determining principles as driveways; there should be some reason for their being, as for instance, to lead to a gate, a door, a seat, or some other feature. Their construction is also similar to driveways. On steep grades, steps can be worked in to advantage; also an opportunity to show

originality on the design of buttresses, walls, etc., is here given. Where a path is seldom used or where a solid walk threatens to cut through a lawn, stepping stones are desirable, set in so the lawn mower will pass over them.

Use of Shrubbery Beds.—Shrubbery beds are used to screen off undesirable views and angle points, border division features and for foliage effects, etc. Shrubbery beds should be shaped to conform to the purpose and location of the bed. The ground plan of the planting should show prominent points and deep bays. The extent of a particular section may be apparently increased by the appearance of distance made by a plantation bay. In planting, strive to get simple, broad effects instead of startling, unusual ones. It is better to secure more restful and peaceful results and impressions than unnatural effects.

Plan to plant in groups and masses rather than in spotting the lawn with individual shrubs. A lawn in which the shrubbery is spotted in individual specimens seems to be much smaller than the actual dimensions, while a lawn with an open center and the shrubbery grouped on the border will have just the opposite effect, and will give the effect of spaciousness. A single row of trees or shrubs for a screen is not so good as a broad mass planting. In planting a group do not arrange the plants in rows or tiers. It is a good plan to observe how Nature masses the shrubs by intermingling the various trees and shrubs. This does not mean that the plants should be shuffled and placed in a haphazard fashion. Observe the natural groups and you will find character and pleasing effects. Nature enables sturdy plants and trees to stand out above the remainder. In planting in groups, individual plants scattered throughout the groups and separated from one another does not give a natural effect. There should be several of each kind of plants in a group and the groups should be blended into other groups.

Balance in Symmetry.—The human eye naturally seeks balance in symmetry. In Nature the idea of balance about some common center is evident. Do not take this suggestion too literally and duplicate individual shrubs about a common axis, but use shrubs of similar habits and similar positions, although not necessarily identical positions. It is not necessary that expensive nursery grown shrubbery be used. It is, of course, more desirable and convenient, if nursery stock could be secured, but very often it is possible to secure native shrubbery from the adjoining woods which, when properly transplanted and cared for, will respond and create some wonderful effects.

Since landscaping is more or less a sideline of mine, I will let you in on some of the secrets of the business. For instance, you are probably all familiar with the so-called buck bush which grows promiscuously in the woods. It is a very simple matter to transplant these successfully with practically no cost. However, when a landscape architect handles the buck bush for the client the name is changed to symphorycorpusresmorus and the cost of the plant is from 10 to 25 cts. each.

The introduction of some pointed pyramidal shrubs or trees, such as lombardy poplars, at salient points gives character and adds interest to an otherwise monotonous planting. Trees should be placed at desirable points for shade and to form vistas. Good judgment should be used in the planting of trees so that, as they grow, they will not interfere with the operation of the water works plant.

The Importance of the Lawn.—There is no feature of landscape planting which is more important to the successful beautification of property than a beautiful lawn. Its importance is seldom appreciated and too often the lawn is not properly considered. It is the foundation and background upon which the various features are placed to form the picture. It harmonizes and ties the various features together with pleasing contrasts. A good lawn is similar to a well dressed person; it is not conspicuous unless deficient. Brown or unburnt spots or weedy patches attract attention to the lawn and minimize the effect of all other features. The lawn will respond readily to treatment and attention.

Too often a lawn is expected to grow on excavated clay and shale or on a thin layer of soil covering piles of rock and building debris. A properly prepared loam bed will repay many times the extra trouble necessary, when the drouth comes late in the summer. The grading of the lawn, apparently is a very simple matter, but is very important to the final appearance.

The topography should be carefully studied and a contour of the lawn should form an integral part of the landscape. It should blend from one elevation to another without abrupt change. A perfectly level piece of lawn with informal and irregular surroundings is entirely out of place. Long, flowing, sloping lines should be maintained. This will also enable the lawn mower to be more easily operated and the lawn to be kept in better condition.

Location of Flower Beds.—It is poor practice to put flower beds or rose beds in a lawn in every conspicuous place. They should be placed along the edges of the scrubbery border in convenient protecting bays. The shrubbery forms a good background and a frame for the blooms, and the maintenance of the grass edges around the flower beds is reduced to a minimum.

Roses are beautiful when in bloom, but in other seasons they are an unsightly group of briers. The best place for roses is a separate area grouped in a rose garden, or along fence or trellis. Roses will do better when protected from strong winds than when set in an open lawn.

For the extensive and elaborate grounds other features may be worked into advantage. Seats conveniently placed are very interesting; pergolas, monuments and statuary all have their place and can be worked in from time to time.

It is the hope of the speaker that the suggestions outlined will enable some operators to at least make a beginning in beautifying the grounds around their water works plants, although on a very small scale, with the idea that the satisfaction and results obtained on this small scale will encourage them to work more and more to the end that before many years the water works plant will be the most important and attractive spot in town and a respected utility.

Mosquito's End Looms in Air Dusting Method

Hope for eventual extermination of the malaria-spreading mosquito and his less dangerous but pesky brethren is seen by Public Health Service authorities in recent results of airplane dusting experiments in swampy areas near Bamburg, S. C.

These experiments are said to have demonstrated the value of the airplane in spreading paris green over large marshes and swamps where drainage or other methods of eradication are impracticable. Navy 'planes with dusting equipment were flown over the South Carolina swamps, releasing the poisonous powder over the mosquitoes' breeding places. At least 90 per cent of the larvae, the investigators estimated, were killed.

Paris green, which contains arsenic, will stay dry and remain on the surface of water at least two hours. In that time the larvae can be expected to come to the top at least once, and are almost certain to receive a death-dealing dose. The method is said to be just as effective against salt marsh mosquitoes as against the malaria-spreading variety, and by repeating the treatment over a period of years the authorities believe that a nearly 100 per cent destruction can be attained.

Public Health Assn. Meets in Chicago

The 57th annual meeting of the American Public Health Association will be held in Chicago from October 15 to 19. A very interesting program and a number of inspection trips have been planned, according to Arthur E. Gorman, secretary.

The Annual City Report

Its Purposes and What It Should Contain

City officials are frequently so busy with other administrative tasks that they overlook the necessity for reporting to the citizens concerning what is being planned and accomplished. Clear and understandable reports are the basis for citizen appreciation of what the city government is, what it is doing, and what it may do. A valuable pamphlet, "Reporting Municipal Government," and discussing and appraising the existing facilities for, and methods of, reporting the conduct of city government, has just been issued by the Municipal Administration Service, New York City. The author is Wylie Kilpatrick, Associate Research Professor of Government, at the University of Virginia. We are reprinting below that portion of the pamphlet relating to the annual city report.

MANY editors of reports view facts, as one observer put it, as "born free and equal." Lest any discrimination be made against some facts, they are included—all of them. But the first essential of the city report should be to discriminate among facts. A charter or law many require the publication of either reports or advertisements; but legal printing may be secured without encumbering the annual report with the deadweight. Large parts of many present-day reports are devoted either to the limited interest of a small public or to the interest of the city employees. Their sole service is to furnish a portly compendium of reference.

Annual Report Should Serve Public.—The annual report should be functionalized to serve the public. The "public" has a variety of shadings. Reporting must therefore follow a variety of methods. Within the same volume the story must be told concurrently in three ways: graphs and charts, statistics, and interpretative comment. And each of these methods achieves value by brevity. Last year President Coolidge took 12 words to decline a presidential nomination that was conceded to him; a month later another leader took 1,200 words to decline a nomination that would have been disputed. No primer of report-writing can be a substitute for a sense of values in determining how a story should be featured.

Editors of city reports are beginning to lift the incidents of import and interest from the bottom of tabular statements and to display them in stories and pictures. For example, the report of Lynchburg, Va., is a readable balance of pictures, tables, and explanatory comment. In a neighboring city, Petersburg, the report is turned into a manual of city government. No person can go through its 85 pages, and the reader is tempted to finish the volume, without an understanding of the structure and operation of a municipality as revealed by a record of one year. A running analysis interprets each office and institution. In the original city manager city, Staunton, Va., the annual report is a record of one-sentence paragraphs. The method of the thumb nail sketch is carried over to reporting the budget, a statement of essential figures with corresponding purposes indicated in one line. Supplementary to the annual report in Norfolk was the recent publication of the volume, The City of Norfolk. Not confined to the government but descriptive of the city's social life, the 24 chapters weave in an explanation of the city services with related aspects of community enterprises. Having first sketched how the city government was simplified and how the city budget is prepared, separate chapters analyze the port commission, the school program, city planning, juvenile and domestic relations courts, and playgrounds. It is not a mere dictionary of facts. Nor does the editor's enthusiasm convert it into a booster's booklet.

The Houston, Tex., Report.—A number of objects are in view in the publication of the Houston, Tex., report, and none of them are jostled in the process. The photographic description of city functions does not subordinate the vivid textual explanation. The volume not only contains summaries of the departments, but two editorials introduce the text by comment upon the trend of civic events. The book opens with full-page portraits of the city commissioners and scattered through its pages are pictures of responsible subordinates.

A serious study in the practice of municipal government is the Milwaukee report. By provision of the city code, preparation of the volume is entrusted to the municipal reference librarian, at present F. N. MacMillin. Throwing the statistics into thirty pages in the appendix, the editor presents a thorough analysis of civic functions, although, unfortunately, in type too small for ease in reading.

Less ambitious but equally thorough, is the summary of each department in the Baltimore annual report. The mayor's budget message properly introduces the volume which recently gained recognition by including reports by the notable city commission on efficiency and economy.

The Yearbook of Boston.—The Boston yearbook achieves the almost impossible task of giving form to the reports of each of a multitude of varied city agencies. The reference qualities of this section of the book are heightened by lifting the statistics and presenting them at the end of the volume. Part two is an unsual attempt to enlist writers, either in or outside the city government, to analyze current civic questions or institutions. After an open hint to elderly gentlemen of wealth who are writing their wills, the section proceeds to discuss the port of Boston, transportation facilities, the market problem, and three articles treat of traffic regulation from, the viewpoint of accidents, control, and rules.

Not content with an annual report, Lynchburg issues a monthly bulletin which informs the city of detailed current operations. Why a monthly report is issued is explained by the city manager of Sewickley, Pennsylvania, J. C. Hiteshew:

"Even though the local editor is willing to give us limited space, we have found that . . . (the newspapers) don't tell things the way we would. They don't misrepresent, but they condense many important things and enlarge upon unimportant ones. To end that we started a municipal monthly."

Manager Hiteshew finds that the activities of this Pennsylvania town have news value. Fire prevention week featured one number. Zoning and parking were the topics of another issue. Then came public health. An examination of the ordinances of the city followed with the dead wood exhumed for exclamation points and the live ordinances listed for observance.

Purposes of City Reports.—The better city reports serve: (1) to set forth the accomplishments of a year's administration; (2) to analyze current civic problems; (3) to describe city government as a social institution; (4) to furnish data for judging municipal officials; and (5) to project a future civic program. Ambitious as are these objects, they are attainable in a moderate degree by enlisting the services of competent reporters and editors. Their realization depends upon both a sense of editorial values and the use of

more acceptable devices for presenting data.

Reporting costs affords a means for comparison between years or between cities. However uncertain may be uniform cost accounting as a basis for exact measurement of results, the unit measure of foot, year and ton are terms into which fiscal statements can be reduced. The weighting of cost units to correct fluctuations between years or localities may be a development of future reporting methods. The use of unit measurement is the immediate end. The trend of governmental expenditures over a period of years is shown in research reports with due allowance for the fluctuation of the dollar. This is a simple device that can be approximated by the adaptation of standard tables, as those of the United States Labor Bureau, even though precision cannot be secured without the formulation of tables for individual cities. The actual trend of public costs then can be related to community income and the degree of absorption of income by taxes—a subject ever giving zest to headlines—can be approximated. Without converting the city hall into a research laboratory, the simpler statistical devices can be employed to penetrate the smoke screen of rumor surrounding current discussion of financial issues.[1] At all events, the "report should not be," as C. E. Ridley puts it, "a pretty picture book jammed with canned propaganda to win an election."

The varied contents of American municipal reports indicate that for the large city, at least, the publication of a single volume is a mistake resulting from an unthinking adherence to obsolete forms. The failure of city reports, if traced to one cause, may be attributed to their attempt to serve too many purposes within a single volume. For the small city, a sectional treatment, and for the large city, the issuance of a series of small books or pamphlets is far superior to piecing together a miscellany of reports and patching book covers around them. Departmental or functional reports are becoming not infrequent. For example, the current report of the Milwaukee Health Department details its activities and performance. In 1926, the city assessor of St. Paul issued a report which is at once a record of his department and a manual on assessing.

Aside from technical publications, the annual city report invites division into several pamphlets. The citizen requires a knowledge of what his city government is and how it is formed structurally. Not every year need the description be repeated in an annual report: occasional publication in a separate pamphlet is preferable. What the city government does forms a current record compelling annual publication. Stripped of unessential statistics, the record becomes a story of local civic life. Something over 100,000 copies were printed of the pamphlet issued by Detroit's mayor and council under the caption, "Detroit's Government, a short story of the services rendered to the people of Detroit by their city government." What the city government may do, a third subject for separate treatment, very generally remains undefined in the minds of officials and voters. Pamphlet publication would serve a function in formulating municipal objectives.

[1]See A. E. Buck, "Municipal Finance," chapters VI and VII on "Cost Accounting" and "Graphic Statistics," respectively.

Work Progressing on Akron Interceptor

Akron's new $3,750,000 sewage treatment plant at Botzum, Ohio, will begin operations the first of the year. The plant itself was completed early this year, but litigation held up work on the large interceptor sewer connecting the plant with the Akron sewer system, and delayed the start of plant operations.

Under the present construction schedule, the two sections of the interceptor sewer, being built along and on a fill of the old Ohio canal through the valley will be finished by Dec. 1. Work is being rushed by the Holmes Construction Co. and the T. E. McShaffrey Construction Co., contractors working on the interceptor.

The sewage will enter the plant through the interceptor at the south end of the treatment unit, where the administration building, shops and garages and other offices are located.

Two meters in the basement of the administration building register the amount of sewage entering the plant, which has a capacity of 33,000,000 gallons a day. Before passing through the meters the sewage passes through two detritus tanks, which take out all grit, grease and trash.

Settles in Tanks.—The Imhoff tanks, 24 in number, first receive the sewage. The sewage settles in these tanks, and all suspended organic matter goes to the bottom and decomposes.

From the Imhoff tanks the fluid sewage goes to the filter beds, 14 acres in extent, formed of 6,000 carloads of crushed limestone, spread 10 feet deep. The fluid sewage is sprayed out over these beds, through a pipe system, controlled from four dosing tanks located at spaced intervals on top of the limestone beds. These tanks are automatic, filling up and discharging through the pipes at regular intervals.

The material deposited at the bottom of the Imhoff tanks is drawn off at regular intervals and goes to the sludge beds, four acres in extent, located next to the Imhoff tanks. The material dries out on top of the sludge beds and is taken away to the dump. A complete network of tracks covers the sludge beds, used in carrying away the dried material.

The final step in the treatment of the fluid sewage is the passage into the secondary settling tanks, where the solid picked up in the trip through the other parts is allowed to settle, and the sewage when it leaves the plant to flow into the river, is practically free of all organic matter.

All the land around the plant is being landscaped, and in another year, lawns and terraces will completely surround the entire plant.

New York Has New Traffic Signals

A new traffic light system in West End Avenue, from Sixty-third to 106th Street, in New York City, was recently turned over to the Police Department by Commissioner Albert Goldman of the Department of Plant and Structures. The posts, control apparatus and lanterns were designed by the Department of Plant and Structures to conform with the equipment used in other streets.

The cost of the system was about $14,000. Ten miles of wire were used in making connections. Police protection for the forty-three intersections involved would amount to $215,000 a year, while maintenance of the signals will be less than $3,000 per year.

Thirty-one signal lights controlling traffic at 104 street intersections were installed in Lexington Avenue recently. Fifteen other signals were placed in service on Liberty Avenue, Brooklyn, at about the same time.

Work on signal systems along Avenue A, Riverside Drive, Lenox Avenue, Madison Avenue and Upper Broadway, Manhattan; Flatbush Avenue, Brooklyn, and Southern Boulevard, Boston Road, East Tremont Avenue and Prospect Avenue, the Bronx, is rapidly progressing and will be soon completed. As systems are completed, cables are being extended to a central control station at West Thirtieth Street, between Sixth and Seventh Avenues, Manhattan. Five systems have been extended to the control station.

Water Works Men Meet in Huntington

The Central States Section of the American Water Works Association met in their 30th annual convention in Huntington, W. Va., on August 23 and 24. The sessions were held at the Prichard Hotel. Well known men discussed such subjects as Pitometer water waste surveys, water purification, corrosion, valuation and rate making, and other topics of interest. E. E. Bankson, of Pittsburgh, is secretary-treasurer of the section.

Filter Plant Operating Kinks

Methods and Devices Used by Ohio Plants

ONE of the most interesting features of the last annual conference of Ohio engineers and operators of filtration plants was the progress reports on filter plant operation, and the discussion of the various miscellaneous problems confronting the operator. In this discussion some interesting methods were brought out which we are describing below, our information being taken from the recently issued seventh annual report of the conference.

Mechanical Control of Wash Water Application.—At Bellaire, O., filters are washed directly from the high service pump discharge. E. J. Lewis, chief engineer of the water works, has developed and installed a wash water control valve, hydraulically operated and located on the main wash water line where it enters the pipe gallery. Each individual filter has a wash water valve which is hand operated. In washing a filter these individual wash water valves are difficult to open, due to the high pressure maintained, and if these valves were opened before the hydraulic control valve there would be too great an inrush of water in the filter with the possibility of overturning the filtering material. To guard against the possibility of the operators washing filters in this way, a "fool-proof" control device was placed on the hydraulic valve so that it will open slowly and close slowly. The length of time it remains open is also mechanically controlled for any predetermined period. By setting the device it is possible for the filters to be washed properly by any operator, and the superintendent knows that there is no danger of overturning the gravel and sand even though he may have a more or less undependable operator. The device is shown in Fig. 1, and may be described as follows:

A small tank T of about 2 gal. capacity has a fixed overflow and an orifice in the bottom adjusted by valve G to empty the tank in a given length of time through waste line K. In the accompanying diagram the main wash water control valve L is closed and water flows from a pressure line connection through a 4-way valve I, through line N to top of hydraulic cylinder and through valve S into tank T either through the top or the bottom orifices. The flow into tank T is continuous until the 4-way valve settings are changed. Water runs to waste from tank T through the overflow line.

When ready to wash a filter the wash water valve on the filter is opened wide. Then the setting of the 4-way valves of the control device is changed by raising lever A until notch B engages pawl C. This connects the pressure line into the under side of the piston in the hydraulic cylinder through 4-way valve I, and valve L begins to open. Water from above the piston in the hydraulic chamber flows through line N, through 4-way valve I, through valve H and 4-way valve J to waste line P. The rate of opening of the valve L is governed

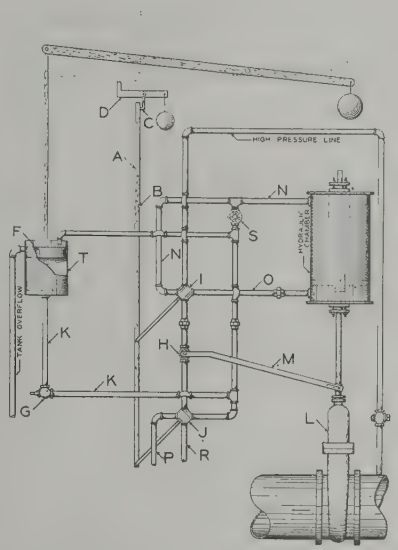

Fig. 1—Automatic Control Device of Hydraulic Wash Water Valve at Bellaire, O.

by the rate at which waste water will flow from the upper side of the piston in the hydraulic cylinder. It is controlled by the valve H which begins to open as the stem valve L rises, valve H being connected to the stem of valve L by lever M. Valve L remains open until the setting of the 4-way valves is returned to the position shown in the diagram. The length of time the valve is held open is governed by the length of time it takes for tank T to empty through the orifice in the bottom and it is regulated by valve G for any predetermined period. As water flows out of tank T through line K, valve G, 4-way valve J, to waste R, the float F drops, trips lever D and disengages pawl C from notch B in lever A, which drops to position shown in diagram.

The rate of closing of valve L is governed by the rate at which waste water from the under side of the piston in the hydraulic cylinder discharges. This is controlled by the valve H in the reverse manner in which the rate of opening of valve L is controlled.

Tank T again fills from the pressure line and through line K from the under side of the piston in the hydraulic cylinder and float F assumes position shown in the diagram, which completes the cycle.

Detection of Condenser Leakage by the Bacterial Method.—The Toronto plant of the Penn-Ohio Power & Light Co. is one of the largest electric generating plants in the state. The plant is equipped with steam turbine driven generators and condensers through each of which 86,000,000 gal. of river water are pumped daily. Some idea of the size of the plant may be gained from the fact that entirely within the building there is a 3 m.g.d. water purification plant which consists of mixing chambers, coagulation basins, filters and clear well. The filter plant is under laboratory control and the quality of water meets the U. S. Public Health Service standard of purity.

In the operation of a power plant of this kind the detection of small amounts of leakage in the condensers is most important from an economic standpoint. Several methods of making tests for condenser leakage have been in general use in industrial plants. They may be enumerated as follows: (1) The test for chlordies by silver nitrate; (2) the test for hardness by soap solution; (3) The test for conductivity by a potentiometer. These tests are all useful, but have the disadvantage of not being very sensitive for a small amount of leakage.

The idea was conceived by L. W. Radman, the plant chemist, that as the superheated steam reached a temperature of 670 deg. C. the condensate should be sterile, and that if any of the condenser tubes were leaking, permitting raw river water to enter the cosdensate, that even slight contamination would be indicated by its bacterial content. Accordingly bacterial counts were made daily on water from each condenser for some time without any bacterial growths on agar plates. To check the results condenser No. 1 was shut down and was found to have no leaks. The agar plate counts were continued. After six weeks the condensate from condenser No. 2 was found to have a high bacterial content which indicated leakage. As the engineer was unable to note any change in the amount of make-up water required for this unit, it was continued in service until bacterial counts for two more days confirmed the previous finding. The unit was shut down and tested. Of the 9,450 tubes in the condenser it was found that 6 had very small leaks which would probably not have been discovered by any other method.

On account of the extreme sensitivity of the bacterial method of testing for condenser leaks it is being used regularly in this plant.

Automatic Altitude Valve for a Wash Water Tank.—The original layout of the East Liverpool plant included a 4-in. pressure line controlled by a float valve for filling the wash water tank. The valve was submerged and considerable difficulty was experienced with the float. The tank was continually running over due to the valve not functioning. D. H. Rupp, the former superintendent of filtration at the plant, installed a Golden-Anderson altitude valve in the pipe gallery of the filter house to overcome these difficulties. The altitude valve is a 3-in. valve which connects a 4-in. pressure line with the wash water line. It is joined to the wash water line by a friction connection held in place with bolts. When operating, the wash water tank is filled back through the wash water line. The upper side of the diaphragm of the altitude valve is connected with the wash water line at a point above the valve.

In operation the altitude valve is simple. The pressure from the wash water tank working on the diaphragm actuates an auxiliary high pressure pilot valve, which in turn opens and closes the sliding piston in the main part of the valve thereby allowing the tank to fill to a predetermined level. An adjusting nut on top of the valve permits its operation very quietly and controls the level of water to within an inch or two. It has given no trouble since it was installed.

Should Trees Be Allowed to Grow Adjacent to Impounding Reservoirs?—The question here raised was in regard to the effect of having deciduous trees growing so close to reservoirs that the fallen leaves would affect the color of the water and thereby increase the difficulties in purification process. T. H. Tristram spoke of his experiences at Wellington in this connection. An effort has been made at Wellington to keep the growth of trees and bushes down to a minimum around the reservoir, and with the cleaning up of the banks of the reservoir a reduction has been noted in color of the water.

At Blanchester the supply is from an up-ground reservoir. There are four poplar trees nearby and it is surprising how many leaves get into the water and cause a black slimy deposit on the reservoir bottom, Mr. Bahlman reported.

Reforestation projects are being conducted adjacent to several water supply reservoirs in the East. The New York City supply reservoirs are heavily planted with pine and spruce. A large reforestation program has been started around the reservoirs of the Scranton, Pa., Water Co. The use of evergreen trees near the water's edge tends to keep leaves of deciduous trees out of the reservoirs. In Ohio reforestation work has been started by the Akron waterworks. The work which is being done there might well be done at many places throughout the state where the water department has extensive land holdings for well sites or reservoir purposes. J. S. Gettrust described the reforestation at the Akron water supply reservoir as follows:

"It is planned to set out 500,000 trees around the water supply reservoir. Four hundred acres are to be used in this reforestation program. Seedlings are obtained free of charge from Edmund Secrist, state forester, at the experiment station at Wooster. The only cost is transportation. There have been 200,000 seedlings about 6 in. high already set out in a nursery. They are set 8 in. apart in rows 3 ft. apart. After being in the nursery three years they will be planted. Trees will be set out in rows 6 ft. apart each way, making 1,200 trees to the acre. Most of the trees are evergreens, consisting of Scotch pine, white pine and red pine, which predominate. Some Corsican pine and Norway pine have been set out. Some deciduous trees are being used, such as the tulip poplar, swamp white oak, upland white oak and black walnut. These trees will not be large enough for merchantable timber for 50 years or more. Besides the trees for reforestation there is adjacent to the reservoir a wonderful fruit orchard consisting mostly of apple trees. Upon the property purchased for the reservoir there were orchards containing 1,000 trees. Nine thousand new trees have been set out and 4,000 more are to be planted to complete the orcharding program. The operation of this fruit orchard requires the services of a trained horticulturist. The fruit farm has proved a profitable investment for the waterworks and it improves the appearance of the grounds adjacent to the reservoir."

What Cities Are Making Routine Tests of Tap Water for Comparison with the Plant Tests, and What Do These Tests Show?—At Cincinnati there are two large open reservoirs on the city distributing system. A part of the city is supplied with water direct from the filtration plant. The bacterial count and the B. Coli index is invariably higher in samples of water collected in the downtown part of the city than in samples collected from the plant or from that part of the system which is supplied directly from the plant. Analyses of samples from the city taps are made regularly.

At Toledo samples of water collected from city taps showed a higher bacterial content than the plant samples and B. Coli were also more numerous. The reservoirs on the system are covered and the increase cannot be explained, but it was remedied by introducing chlorine at two points. The initial application is to the plant effluent. The second point of treatment is at the high service pump station about 2 miles distant. As the total quantity of chlorine applied is the same as when the single point of application was used it is not in any sense to be considered as double chlorination, but rather as split chlorine treatment. Since starting this treatment city tap samples have had a B. Coli index of zero.

At Cleveland samples of city tap water are analyzed occasionally by the water department, but tap water is checked more or less regularly by the city health department. The B. Coli index is greater in these samples than in the water as it leaves the filter plants. Some reservoirs on the system are open and liable to contamination from the air, small animals and birds. This may account for the bacteriological results. But why there should be an increase in bacteria in remote parts of a distributing system, particularly on small pipe lines and dead ends has never been satisfactorily answered, Mr. Ellms stated.

At East Liverpool, Mr. Rupp stated, tests were made of city tap samples during periods when the raw water had a high B. Coli index. In those samples a lower B. Coli index was found than in the plant effluent samples. He ascribed this to the longer period of contact of the chlorine.

Mr. Waring summed up the above remarks by saying that where open reservoirs were on the distributing systems analyses of tap samples were valuable. All reservoirs should be covered, he said, to obviate the pollution of the water by air borne pollution such as was experienced at Cincinnati and described in detail previously by Mr. Bahlman.*

What Is the Proper Size for the Inverted Tube in the Fermentation Tests?—The question was raised by A. B. Cameron as to whether there is any relation between the size of the inverted tube in fermentation tests, and the amount and rate of gas produced in the invert. The sizes of invert tubes vary considerably. It seemed to be the consensus of opinion that the size of the tube had very little to do with the percentage of gas production. Several of the members do consider that some provisions should be made to provide a free opening between the inverted tube and the large tube. At Youngstown all inverted tubes are heated and lipped with a file. At Cleveland all invert tubes are beveled. At Toledo during the past year invert tubes of a different size than those formerly used were purchased. Mr. Furman reports that the average percentages of gas produced seem to be unchanged and that the size of the tube is unimportant.

Can Crushed Stone or Slag Be Used for Supporting Medium for Rapid Sand Filters?—This question was raised because of the ease of obtaining crushed rock and slag, whereas good gravel is often difficult to obtain.

Mr. Furman stated that some small softening installations in Toledo were provided with crushed stone over the

*Sixth Annual Report of Ohio Conference on Water Purification, p. 86.

under drains. Crushed brick was used in one case. The only objection he found was that the smaller sizes could not be graded satisfactorily on account of too much packing. For the larger sizes he said crushed stone has been used with good results in the plants using lime softening. No difficulty has been encountered in washing these filters. These plants were all of less than 50,000 g.p.d. capacity so the results should be considered merely as experimental.

At Sebring the gravel is composed largely of "flats" and Mr. Hess thought that crushed rock would be fully as good. No particular difficulty has been experienced due to this supporting medium, but he concludes that almost any kind of stone would have been as satisfactory.

Mr. Ellms is of the opinion that the smaller sizes of crushed rock would undoubtedly have more of a tendency to pack than gravel. The voids in crushed rock would probably be smaller and when a filter is washed he thinks there would be an increased tendency for the wash water to break through in certain places, leaving areas in the stone which would not get the full effect of the upward flow of the water, and in consequence might develop hard spots. As for the use of slag as a supporting medium for sand in filters, Mr. Ellms raised the question whether its sulphur content might not have a corrosive effect on the underdrain system if it was constructed of iron pipe.

At Sandusky where there is more filter capacity than is required, and where one filter needs to be rebuilt it was indicated by Mr. Schoepfle that a crushed rock or slag supporting medium might be used in it for making an experiment of its practicability.

Supplementary Clauses to Model Traffic Ordinance

In our July issue we printed the tentative draft of the model municipal traffic ordinance, prepared by Committee on Municipal Traffic Ordinances and Regulations of the National Conference on Street and Highway Safety.

In considering the subjects that have been suggested for possible inclusion in the model ordinance, the committee reached the conclusion that some of them could best be treated in separate ordinances. The committee therefore submitted three suggested ordinances providing respectively for the organization of an official traffic commission, the creation of a traffic engineering department and the control of street obstructions. The committee commented on the first two subjects as follows:

Official Traffic Commission.—Every municipal government has as one of its functions the protection of life and property on its streets. The fulfillment of this duty involves the activities of the local legislative, administrative and judicial officers. There is need for appropriate co-ordination between all municipal agencies responsible in the matter of traffic regulation, control and enforcement.

It is recommended that every municipality faced with serious traffic problems create an official traffic body made up of public officials. Membership on such body should, for example, include a member of the city legislative body, a judge of the traffic court, representatives from the street, police and legal departments, and also a representative from the park department if it has any jurisdiction in traffic matters. Such traffic body should advise the city council and the administrative departments of the municipality as to the best methods for administering street traffic regulations and as to improvements and changes requisite for the reduction of accidents and congestion.

Division of Traffic Engineering.—It is also recommended that such municipalities establish a division of traffic engineering and employ a competent city traffic engineer. The city traffic engineer should be a member of any city traffic body established as above suggested. He should conduct studies of street traffic accidents and congestion and of all conditions affecting the safe and convenient use of the streets, collect facts regarding the effect and operation of regulations controlling street traffic, and advise as to the placing, maintenance and operation of traffic signs and signals erected throughout the municipality. He should work in close co-operation with the chief of police or head of the traffic division of the police department.

The suggested ordinances follow:

AN ORDINANCE TO CREATE AN OFFICIAL TRAFFIC COMMISSION

It is ordained by ( ) as follows:

Section 1. Official Traffic Commission Created. An official traffic commission is hereby created for the city of ( ) to consist of the following officials: The Mayor; a member or representative of the (city council), to be selected by the (city council); the (street commissioner or commissioner of public works); the (corporation counsel or city attorney); the (superintendent of police or chief of police); the chief justice of the municipal court; the city engineer; a representative of the city planning commission, to be selected by such commission; a representative of the park commission, to be selected by such commission; and the traffic engineer.

In the event that any department authorized above to select one of its members to serve upon the official traffic commission shall fail, neglect or refuse to appoint such representative, then the other members of said official traffic commission designated herein shall constitute the official traffic commission.

Section 2. Duties of the Official Traffic Commission. The official traffic commission shall advise the (city council), the administrative departments of the city, and the departments and organizations represented upon said commission, of the best methods for the administration of street traffic regulations and of the improvements and changes, both legislative and administrative, requisite for the reduction of street traffic accidents and to relieve traffic congestion.

The official designations inserted above and included in brackets are suggestive of the appropriate officials to be appointed on the traffic commission. A municipality upon adopting any such sections should insert the correct designation of the appropriate public official, board or body.

AN ORDINANCE TO CREATE A DIVISION OF TRAFFIC ENGINEERING

It is ordained by ( ) as follows:

Section 1. Division of Traffic Engineering Established. There is hereby established a division of traffic engineering which shall be under the jurisdiction of the (commissioner of public works, city manager, superintendent of streets) and form a part of the (bureau of streets, street department). The division of traffic engineering shall consist of a competent traffic engineer, who shall be known as the city traffic engineer, to be appointed by the (commissioner of public works, superintendent of streets) pursuant to law, and such other employees as the said (commissioner or superintendent) may deem necessary.

Section 2. Duties of the City Traffic Engineer. It shall be the duty of the city traffic engineer to conduct studies of street traffic accidents and traffic congestion, and other conditions affecting the safe and convenient use of the streets; to collect facts regarding the effect and operation of regulations controlling street traffic; to supervise the placing, maintenance and operation of traffic signs and signals erected by the (department of public works or street department); and to perform such other duties as may be ordered by the (commissioner of public works or street superintendent).

AN ORDINANCE TO CONTROL ROADWAY AND SIDEWALK OBSTRUCTIONS

It is ordained by ( ) as follows:

Section 1. Street Openings. It shall be unlawful for any person, firm, or corporation to conduct any work in streets involving obstruction to traffic, except in the manner and at the times herein provided, as follows:

(1) Permits for work involving obstruction to traffic must be obtained from the (street department, police department) in addition to any other permit required by law.

(2) The distribution of the material or equipment incident to the work shall at all times be such that the minimum number of traffic lanes will be obstructed.

(3) In those sections of any street where parking is prohibited, openings or the temporary storage of materials or equipment which prevent the free use of any portion of the surface will be permitted only between the hours of 6:15 P. M. and 8:00 A. M.

(4) In those sections of any street where parking is permitted for specific periods of two (2) hours or less, openings of the temporary storage of material or equipment which prevent the free use of any portion of the street surface between the hours of 8:00 A. M. and 6:15 P. M. will be permitted only where the work is carried on for at least sixteen (16) hours per day during the time the street is obstructed.

(5) During the period in which a portion of any street is obstructed by an opening or by the temporary storage of material or equipment, there shall be maintained, under the direction of the police department, temporary signs prohibiting parking between points located fifty (50) feet from each end of the work.

Section 2. Hoisting Materials. It shall be unlawful for any person, firm or corporation to hoist steel or building material from any street or from any vehicle standing therein, between the hours of 8:00 A. M. and 6:15 P. M., in such a way as to obstruct or endanger either pedestrian or vehicular traffic in those sections of any street where parking is prohibited.

Section 3. Storage of Materials and Temporary Sidewalks. It shall be unlawful for any person, firm or corporation to temporarily store any material or equipment or to place and maintain a temporary sidewalk in any roadway in those sections of any street where parking is prohibited between the hours of 8:00 A. M. and 6:15 P. M.

Section 4. News Stands, Rubbish Boxes, etc. It shall be unlawful for any person, firm or corporation to place or maintain a news stand, rubbish box, merchandise stand and/or similar obstructions within twenty-five feet of any street intersection.

Cost of Operating Water Department Storeroom.—In the annual report of the operations of the Engineer Department of the District of Columbia for the fiscal year ended June 30, 1927, Mr. J. S. Garland, Superintendent of the Water Department, stated that the total cost of operating the storerooms and yards of the department for the year was 3.424 per cent of the value of the material plus value of equipment disposed of.

The Management of Water Works Business from the Executive Office Standpoint

An Interesting Discussion of the Business Affairs of a Water Department

By GEORGE H. FENKELL
General Manager and Chief Engineer, Department of Water Supply, Detroit, Mich.

THE first essential element in a successful waterworks department is in the employment of a staff of competent workers. The management of a privately operated plant is usually free in the selection of employees, and in the establishment of the salaries that will be paid, but in many municipally operated water works but little attention has been given to the qualifications of the applicant when filling a position. Through the operation of a civil service department having adequate legal authority, and administered by business men who have had experience in employment affairs, it is possible to remove to a considerable extent the difficulties that prevail when employment is used as reward for political services rendered. The establishment of the civil service system, based primarily on the prevention of interference for political or religious reasons in the filling of positions and in making promotions and demotions, marks an important step in promoting efficiency in a municipal water department. The spirit of common devotion will also be improved through the adoption of a system of old age pensions for employees.

The Engineering Force.—A second subject of primary importance is the maintenance of an engineering force that will alow the design for extensions and improvements to be made well in advance of the time that these will be needed in operation. The weakest part of many municipal water projects is the engineering staff that is available for design. When a structure is needed that will require three years to build, with the work carried on in an orderly way, and which can be completed in one year as a rush order, it may be expected that there will be a saving of 25 per cent or more, through the use of more leisurely methods, because the additional time will allow the development of better design, the material can be purchased to better advantage, and labor can be directed in a more economical manner. Even in a well organized department it may be found impossible to solve each problem that arises in a satisfactory manner, and hence the employment of a consulting engineer or waterworks specialist will not only become desirable but necessary if the best results are to be obtained.

The framers of a city charter do not usually contemplate its use as the basis of control for the formation of an organization and for the operation of a construction bureau to carry through to completion projects of exceptional magnitude. Many city charters, however, contain a provision which requires that a contract shall be awarded to the "lowest responsible bidder." The operation of this clause has been objected to by many engineers, but when all things are considered, the writer believes that this is a safe method of procedure to be followed by a municipality.

Centralized Purchasing of Supplies.—Through the use of a department or bureau of Purchases and Supplies it will frequently be found possible to effect substantial savings in the purchases of material. The director or officer in charge of this department has no sinecure. A disadvantage results from centralized purchasing of supplies because of the tendency that it produces for the engineers in the staff of the water department to become less well informed as to what material and equipment can be made available for use, but the gain through the use of such a department is much greater than the loss that it occasions. Many kinds of supplies that are used in a water department are of bulky nature, but if purchases are made in quantity, and if advantage is taken of the low prices that prevail at those times when the manufacturers are eager for orders, substantial savings may be effected, provided adequate and well located storage space has been developed.

Charges for Water Service.—The principal source of revenue for the municipal waterworks department will come from the sale of water, and the charges for water service may be based on measurement by meters, upon rates based upon the number and type of fixtures used, upon rental value of the property served, or a combination of two or more of these. The use of rental value as a measure in determining charges for water is used but seldom if at all in the United States. The use of meters has increased rapidly in the last few years, and while some cities still continue to make collections according to the flat rate or assessment system, the fact remains that many communities are adopting the meter system as the most equitable for the consumers as well as to the works, and of these that have adopted this method for determining charges, not one, as far as the writer knows, has returned to the flat rate system after meters have once been placed in use. While the cost of operating a meter system may be as great as one without meters, it will usually be found that through the use of meters capital investments are reduced and water service improved. As the filtration of water increases its cost and its value, the installation of filtration plants tends strongly to bring about the early metering of the services supplied.

Methods for Reducing Water Waste.—Methods other than by the use of meters are available for use for the reduction of waste and for determining the plans that should be used for strengthening a water system. Among those that are easy to employ are—(a) Measurement of the supply through the use of Venturi meters; (b) leak surveys by water taken from hydrants and used to feed one block at a time through a hose line; (c) pitometer leak surveys; (d) surveys of the flow in large mains by the use of pitometers; (e) hydrant surveys to determine the amount of water available for the fire department at any point; and (f) the use of a number of pressure gauges read hourly and located at several points in the distribution system.

Emergency Crews.—No water department is so small that it does not need to have at least one emergency crew that can respond promptly when a break in a main occurs, for the broken main is the bane of the waterworks management. It usually occurs without warning and without previous knowledge of the time or place where it will occur, and unfortunately the cause for the trouble can seldom be determined later. To maintain men in idleness, subject to call at all times but seldom responding to emergency calls, is uneconomical and will cause their undoing. A plan that has proven satisfactory in some cities is to divide the work of the garage crew into three shifts, to use the garage as an emergency station and the auto repairmen and washers as emergency men for use at those times when serious trouble occurs.

During the past few years there has been a marked increase in the cost of labor and material, but through economies that have been effected by efficient management it has not usually been necessary to increase water rates in the same proportion. However, there has been a considerable increase in the cost of producing water, and this

should be reflected through an increase in water rates in order that the proper balance between capital and income may be maintained. This income should be sufficient to allow the department to operate well, to maintain it in good condition, to pay off annually at least a part of the outstanding debts, to meet the interest when it becomes due and the financial requirements of the sinking fund.

Determination of Water Rates.—There is a great difference in practice in the methods employed in the determination of the water rates in the different cities where meters are used. Some cities charge a uniform rate regardless of whether the quantity furnished is large or small, usually with a minimum charge. When the municipality owns the meters, a meter rental is also frequently charged. Some cities have a variable rate, depending upon the amount of water used by the consumer, and the use of a three step rate is increasing. Service charges which will cover all or part of the unvarying expenses of water service are coming into more general use, as it is believed that this plan is fundamentally more just to the works and to the consumer.

Additional Source of Revenue.—In addition to the funds that will be secured through the sale of water, additional amounts may be obtained through an assessment against the abutting property for the construction of the distribution mains. Collections through this assessment method have not been generally employed, for some cities lack the necessary authority to make such assessments, and in others because of the slow growth of the system, the establishment of such a method for the securing of additional revenue is not justified. This plan for collecting a part of the cost for extensions is recognized as a reasonable one, and the funds that are collected are of substantial assistance in the financing of new projects.

In the collection of income tax from employees of municipal plants, the United States Government has assumed that the function of the water department is proprietary rather than governmental. If the Treasury Department is correct in its ruling and the function of such a water department is proprietary, then it should collect from the city it serves its regular charges for all services rendered the municipality. This would include charges for fire service, for water furnished parks, fountains, municipal buildings, for street sprinkling and flushing, and for charitable institutions of all kinds. The department in turn would be expected to pay taxes the same as any private utility. It has been assumed by many that the free service rendered a municipality is offset in the department by freedom from taxation. It should be remembered however, that there is a difference between the taxpayers and the water consumers, and further, that water service that is rendered free is used with but little attempt to control its use and to reduce its waste.

The management of a privately owned water plant is concerned principally in maintaining the value of the property and in the payment of dividends. The management of a municipal plant is concerned with developing and operating the plant in the way that will best satisfy the citizens and water consumers and in turning back to the plant for capital investments the surplus which is the result of the economies effected through efficient operation.

Private and Municipal Developments Compared.—As the greater number of the water plants in the United States are owned and operated by the municipalities that they serve, it may be inferred that inherent advantages are obtained by serving a community through a municipal department rather than by a privately owned company. While there is no intention to discuss here the complicated problem of private vs. public ownership, the writer ventures to point out some of the advantages of each that affect the business of the departments.

Private management allows: (a) Better control of employees; (b) the payment of salaries somewhat commensurate with the work performed, and hence the employment of those more nearly suited to fill important positions; and (c) prompter action for meeting new conditions of service.

The municipally operated department can: (a) Secure funds at a low rate of interest; (b) operate with expenses for legal services and for litigation reduced to a minimum; and (c) build structures of a more permanent nature than would be possible for a company to construct that operates under a limited franchise.

Few New Uses for Product of Water Department.—There is no single item by which the management of the municipal plant can be judged. The business affairs of a water department differ from those of other public utilities and nearly every other kind of business, in that there are few new purposes for which water can be used. By way of illustration, reference may be made to electric light and power companies, and the gas companies, which have extended the use of their products into fields that were quite foreign to them a short time ago. A few years ago hydraulic elevators and water driven washing machines came into limited use, but the amount of water used for these purposes now is very small. The cooling of the air in retail stores and theatres through the use of appliances requiring cooling water has been used to a limited extent, but with all of the methods that use water in new ways the amount required is almost negligible.

Retaining Good Will.—As a water department usually has a monopoly in the community which it serves, and as the new uses for its product are few, it does little advertising and maintains no sales department. In this respect it also differs from nearly every other kind of business. It is essential, however, that the department maintain the good will of the consumers, and the only channels open for doing this are through the maintenance of the visible portions of the plant in a sightly condition, the rendering of good service and the publicity of its aims and endeavors. The reputation that the department enjoys will be no less due to the promptness anl courtesy of employees and the speedy adjustment of its accounts and complaints, than to the excellence of its mechanical equipment and the adequacy of its supply of a wholesome product.

There is little use in collecting and summarizing data unless some good use is made of them after they are collected. The records in the department are collected, preserved and summarized;—(a) To make possible the prompt collection of all the monies due the department; (b) to determine when payments must be made and the amount of the bills that must be met, and to pay all bills when due; (c) to keep down the cost of plant operation and maintenance, and (d) to determine the future needs of the department in such a manner that the construction requirements will be met in the best and cheapest manner.

Financing and Administering Sewers.—Many cities find difficulty in securing funds needed for essential improvements through the limitation established by law or otherwise. However, owing to the elemental need of an adequate supply of wholesome water, laws regulating the finances of a city are usually less restrictive with the financing of water projects than for other improvements. Principally because of this difficulty in securing funds, consideration has been given recently to the proposal that the portion of the sewer system that is concerned principally with the dry weather flow be financed and administered by the municipal water works. To what extent the sewer system would be so financed and operated would depend upon legal and financial restrictions of the communities in question, and also on local usage and municipal laws. With some, the entire sewer system would be included, while in others storm water sewers would be excluded. Whether or not sewage treatment works would be included would depend upon local circumstances. In the establishment of tax rates, as well as the rates to be charged by public service corporations, the word "equitable" is used freely and without a realization that "ability to pay" is often the deciding factor. As the sewers that carry away the dry weather flow operate in conjunction with and are a necessary supplement to the water system, and as most of the water sup-

plied is removed through these sewers, and as the demand for sewer capacity is in almost a direct ratio to the amount of water used by the consumer, it appears reasonable that administration of the affairs of the sewer system can, in some cases at least, be joined with that of the water department. Objections to the adoption of such a plan would probably be raised by railroad companies which use large quantities of water for locomotive boilers, and by some others, but the number of these would be relatively few. While no general rules on this subject can be stated now, it seems quite certain that within the next few years this method of financing and operating sewerage systems will be given increasing consideration by the governing bodies in many cities.

Fire Protection Demand.—A well operated water plant is a great asset to a community for a number of reasons that are apparent and which should be appreciated by the consumers. Its effect in accomplishing a reduction in fire insurance rates, or in maintaining low rates already established, is at present generally intangible. It is to be regretted that the fire insurance companies have not found it convenient to evaluate improvements needed for fire prevention purposes.

Excepting those that have given the subject careful consideration, few realize to what an extent the demand for fire protection service influences the design and cost of a waterworks system. "Experience has shown that the cost of the portion of the waterworks involved by fire protection service in this country generally constitutes from 60 to 80 per cent of the entire cost of the physical property in the case of communities having less than 10,000 population; 30 to 40 per cent in communities of about 50,000 population; 20 to 30 per cent in communities of about 100,000 population; and 10 to 20 per cent in the case of our largest cities." *

Finally, the prosperity and growth of a city will continue to be contingent to no small degree on the excellence of the water works system and the reasonableness of its water rates. In the coming years it will be found that to maintain the works at a high degree of efficiency and to furnish water at rates that are consistent with the capital costs and other expenses involved, the ingenuity of the waterworks management will be taxed to an ever increasing degree.

Acknowledgment.—The above is an abstract of a paper prepared by Mr. Fenkell and read at the annual convention of the American Waterworks Association by D. C. Grobbel, chief clerk and acting secretary, department of water supply, Detroit.

*Water Works Manual, page 593.

Canada Preserves Historic Sites

The Department of the Interior of Canada has been carrying on the work of preserving and restoring historical ruins and suitably marking the sites of historical events. On the recommendation of the Historic Sites and Monuments Board the department through the National Parks Service, has marked 118 sites by the erection of memorials. Each year at the annual meeting of the board the suggestions of members are reviewed and a number of sites are recommended for marking.

In 1927 tablets were placed on twenty-five sites. One of the most picturesque ceremonies was the unveiling of the cairn and tablet at Blackfoot Crossing, near where the Cluny-Milo section of the Alberta Provincial highway crosses the Bow River. This memorial commemorates the signing, on Sept. 22, 1877, of Treaty 7, by which the wide plains were thrown open to the white man and peace was assured to the Indians. The Indians relinquished their claim to 50,000 square miles of fertile prairie in Southwestern Alberta by this treaty.

Indian treaties signed in each of the other Prairie Provinces, Manitoba and Saskatchewan, are also to be commemorated. Treaty 1 was signed at Lower Fort Garry, Manitoba, on Aug. 3, 1871, and Treaty 6 at Fort Carlton, Sask., between Aug. 23 and 28, 1876, and at Fort Pitt on Sept. 9, 1876.

Recently the 1928 meeting of the Historic Sites and Monuments Board was held at Ottawa. One hundred and ten sites were reviewed and a number were selected to be marked as of national importance. Brig. Gen. E. A. Cruikshank, a recognized authority on the military history of Canada, who is Chairman of the board, presided.

Of the new sites or events selected for commemoration the following are outstanding in the official list:

"Hillsborough, N. B.—Site of the Battle of the Petitcodiac, August, 1755. This was the last action in connection with the removal of the Acadians.

"Sydney, N. S.—Political reunion of Cape Breton and Nova Scotia, Oct. 16, 1820.

"St. Johns, Quebec—Site, near here, of the Battle of Montgomery's Creek, Sept. 6, 1775, with Montgomery's invading army. The defeat of the invaders had the effect of repelling a formidable invasion for the time being and created great enthusiasm in the country.

"Nanticoke, Haldimand County, Ontario—On Nov. 13, 1813, the Norfolk Volunteer Militia routed a band of marauders that had terrorized the country. This exploit inspirited the military forces, restored the confidence of the people and was an important factor in the immediate recovery of lost ground.

"Fort Drummond, Queenston Heights, Ontario—Fort built by military labor for the defense of the frontier in 1814 and named in honor of Sir Gordon Drummond.

"Niagara-on-the-Lake, Ontario—Commemorating the treaties concluded with the Chippawa and Mississauga Indians by Colonel Guy Johnson, May 9, 1781, and Lieut. Col. John Butler, May 22, 1784.

"Kingston Navy Yard, Kingston, Ontario—The British naval station for Lake Ontario during the years 1788-1818. Here were built fourteen ships. In the War of 1812-14 this naval station enabled the army to retain control of Upper Canada.

"Amherstburg Navy Yard, Amherstburg, Ontario—The British naval station for Lakes Erie and Huron during the years 1796-1813. Here nine King's ships were built. In the War of 1812-14 this naval force enabled the army to retain control of that frontier.

"Fort Fork, Alberta—Situated near the junction of Great Smoky and Peace Rivers and erected by Sir Alexander Mackenzie, 1792-3. It was from this fort that he started on his perilous and historic journey to the Pacific."

In addition to the above the board recommended that the public services of the following outstanding personages in Canadian history be suitably commemorated:

"Three Rivers, Quebec — Benjamin Sulte, outstanding historian and poet. Born, Three Rivers, September, 1841; died, Ottawa, August, 1923.

"Annapolis Royal, N. S.—Samuel Vetch, Adjutant General of the force which captured Port Royal, 1710. First Governor and Commander-in-Chief.

"Toronto, Ontario — Sir Gordon Drummond, a successful and talented military commander, who served with distinction in the War of 1812, and who administered the civil affairs of Upper and Lower Canada at critical times."

Reading Considers Water Works Loan

Instead of floating a bond issue to pay the municipal improvements, consideration is being given to a plan for mortgaging the city's water works to raise money, according to a statement made recently by Mayor J. Henry Stump, of Reading, Pa.

"City Solicitor John G. Rothermel has investigated the matter," declared Mayor Stump, "and has found it to be perfectly legal. We plan to borrow $1,500,000. The assets of the works are figured at $12,000,000. The money raised by this mortgage would be used to pay for the condemned land in the Maiden Creek Impounding Dam area and for improvements to Hampden Reservoir."

Mayor Stump emphasized the fact that by mortgaging the water works no increase in water rates would follow.

Force Account on Unit-Price Construction Contracts

Philadelphia Bureau of Municipal Research Presents Valuable Study

THE purpose of this report is to discuss methods of handling force account on unit-price contracts for public works in Philadelphia. Philadelphia's practices are analyzed and compared with practices in other cities. The report ends with a summary of conclusions and recommendations for Philadelphia.

Prior to the analysis of particular force-account practices, the report defines "unit-price contract" and discusses the problem presented under such contracts by work which is part of the project contracted for, but which is not foreseen when the contract is let, and which is not covered by the price bid. "Force account" is then defined and shown to be one of the methods of performing and paying for extra work.

Sources of Information.—In order to discover the best practices and to provide fair standards by which Philadelphia's practices might be measured, the Bureau of Municipal Research has examined the specifications of 31 public authorities responsible for letting contracts for public works, who make provision for force account.

The Standard Municipal Contract Form, published by the American Society for Municipal Improvements, has also been examined.

In addition to the specifications that were studied, opinions have been obtained from about 20 experienced engineers and contractors in various parts of the country.

Extra Work.—The mayor and council, assisted by the engineers of the city department having jurisdiction, and possibly by consulting engineers not connected with the city administration, having decided upon the necessity, the location and the financing of a project, the engineers begin the work immediately precedent to advertising for bids. The site is explored with test pits and borings to find rock or other material upon which the structure may be founded, and to ascertain the quantity and kind of material which must be excavated. This information is a determining factor in the selection of the type and the extent of the foundation structure. The plans are drawn and an estimate of quantities is made from which a schedule of items and quantities is prepared, and specifications written.

Plans Drawn.—Plans supplemented by the specifications, together with the schedule of items and quantities, are prepared to show the bidder what will be required of him. The plans, specifications, schedule, and agreement combine to form one instrument under which the work is to be done. Attached to the specifications, and forming a part thereof, is the schedule of items and quantities.

The late Thomas Skelton Harrison of Philadelphia gave the residue of his estate to a board of trustees to be used "generally for such purposes as will contribute toward improvement of governmental conditions in the city of Philadelphia." These trustees organized the Thomas Skelton Harrison Foundation to administer these funds.

Among the special purposes mentioned in Mr. Harrison's will is the obtaining and dissemination of information about municipal affairs in Philadelphia. That Mr. Harrison also had a special interest in city contracts is indicated by the authority given to the trustees in other parts of the will to use the fund to secure the impartial enforcement of such contracts.

It therefore seemed to the trustees to be especially fitting and in line with Mr. Harrison's wishes that a study be made of the methods followed in Philadelphia in the preparation, letting, and performance of contracts for municipal work. The Bureau of Municipal Research was engaged to make such a study as the Foundation's agent and at its expense.

The following report, "Force Account on Unit-Price Construction Contracts," deals with one of the subjects to which the Bureau has given attention in the course of the study. This very interesting report, prepared by their Civil Engineer, Mr. Phillip A. Beatty, is abstracted extensively in the following pages for the benefit of municipal authorities throughout the country.

The general practice is for the contractor, in making his bid, to indicate on this schedule the unit prices for which he will do the work. These unit prices, multiplied by the number of units, give the "extensions." The sum of the extensions is the "bid price." The bid prices are compared and from them the "lowest responsible bidder" is selected.

Added Work.—If the schedule indicated every item and the total quantities with absolute accuracy, and if the plans and specifications were perfect, there would be no necessity for extra work; and, if all went well with the contractor, the contract could be completed at the price bid. This probably never occurs on major work. During construction it may be to the city's advantage to make extensive alterations in the plans, or unforeseen conditions may arise to upset preliminary calculations. Since these contingencies cannot always be foreseen, the price bid by the contractor does not provide for the added costs. Hence, when the added work is done, the contractor feels justified in claiming additional compensation.

How shall the additional compensation be fixed? The problem is simplest when the added work is comparatively small in amount, and of a kind for which a unit price has been bid. Most specifications reserve to the engineer the right to increase or decrease the itemized quantities after the letting of the contract, paying for the work actually done at the unit price bid. No limit is placed upon the increase or decrease by the Philadelphia specifications, but such limits are found in some contracts for public work. The department of public works of Baltimore, for example, restricts the change to "less than 20 per cent of the total amount of the contract price."

This report is not especially concerned with additional work. It is rather concerned with "extra work," which may be defined as (1) work of a kind for which unit prices have been bid, but in excess of the quantity which the contractor is obliged to do at the unit prices, or (2) work of a kind for which no provision at all has been made in the schedule. Compensation for extra work may be fixed by a supplementary contract or under an extra-work clause in the contract. The latter is generally used.

Extra Work.—There are several methods by which the contract may provide for payment for extra work. These are:

1. At the unit prices bid by the contractor.
2. At fixed prices stated in the specifications.
3. Under a special unit-price agreement between the contracting parties.
4. With a lump sum, agreed upon between the engineer and the contractor.
5. By force account, on a cost-plus-a-percentage basis.

6. At cost plus a fixed sum.

Which of these is preferable depends upon the particular circumstances. Each method may have advantages and disadvantages.

The first method, of course, can be used only where the extra work is of a kind covered by the unit prices. If it can be used it is usually the best method.

Fixing the prices in the specifications, the second method, gives the contractor no choice concerning them, and is open to the objection that the prices fixed may be lower than the price for which the contractor thinks he can do the work. In that event he must be willing to accept a loss, refuse to bid, or add something to another item to make up a possible shortage. As the specifications give only the fixed prices for the extra work, and not the quantities, a definite conclusion as to additional costs cannot be reached by the contractor and he must add what he hopes will be enough to cover them. On the other hand, if he considers the fixed prices high enough to yield a good profit, he is debarred from reflecting this thought in his estimate, because it may happen that no extra work will be done under these prices.

A special unit-price agreement for extra work, the third method, has much to recommend it, if approached in a fair, open-minded manner by two experienced men. However, the contractor is usually better equipped than the engineer for this bargaining, since he is in daily touch with costs, while the engineer has them only at second hand.

The fourth method is the "lump-sum" agreement. As compared with other methods, this one seems to have no special advantages. If it is used, there are only two ways to arrive at the lump sum. One is an "intuitive estimate"—that is, a guess; the other, a knowledge of unit prices and quantities. Some intuitive estimaters are good guessers, and some are not. This makes the results uncertain. On the other hand, if the unit prices and quantities are known, the first or the third method would seem preferable.

Force Account.—"Force account," the fifth method of paying for extra work, places the contractor's forces, or a portion of them, at the disposal of the employer's engineers. Separate accounts are kept of the cost of these forces and of the materials incorporated by them in the structures, and these costs, plus a percentage of them previously agreed upon, are paid to the contractor. The percentage is intended to cover overhead, general supervision, and other items set forth in the specifications. Force account, then, is a term used in this report to designate work which is done under the contract, though not included in the contractor's bid, and which is paid for at cost plus a percentage. Although this report deals especially with force account as a means of performing and paying for work which is not foreseen at the time a unit-price contract is let, it should be understood that force account may be a method of performing and paying for the entire job.

The sixth method is cost plus a fixed sum. This method is listed in the Standard Municipal Contract Form issued by the American Society for Municipal Improvements. It is similar to force account except that the contractor receives a fixed sum in addition to the cost of the work instead of cost plus a percentage of the cost. The intent is to remove any incentive to increase the cost of the work which may exist if a percentage of the cost is paid.

Philadelphia Methods.—The departments of public work, city transit, and wharves, docks, and ferries let most of the contracts for public works in Philadelphia. Their methods of paying for extra work differ.

The department of wharves, docks, and ferries does not use force account. When the necessity arises of doing unforeseen work, a special agreement is entered into with the contractor.

In the department of public works the specifications of the bureaus of highways and engineering require the contractor to accept for any extra work which may be ordered by the engineer (1) the unit prices bid, and (2) the fixed prices for contingent work given in the specifications. Should neither of these methods apply the work is to be done at a price agreed upon in writing by the contractor and the engineer, and approved by the director. The extra-work provisions of the specifications of the bureau of highways end here, but those of the bureau of engineering go one step further, providing for force account if the other methods are impracticable.

Specifications of the department of city transit provide "for such additional work . . . at the unit prices bid where applicable, or, when the unit prices do not apply, at the discretion of the director, either at a price agreed upon in writing by the director and the contractor or under force account."

In Philadelphia, therefore, force account is a method of paying for extra work in the bureau of engineering (department of public works), and in the department of city transit. In these units it is a method provided for use in the event that other methods fail. Because of its adaptability to all situations, its flexibility and elasticity, force account is a useful alternative of the other methods. The other methods have their disadvantages, and those which depend upon agreement between the contractor and the engineer may be impracticable because of the impossibility of reaching an agreement. It is desirable, therefore, to be able to fall back upon force account when other methods fail.

In the 30 specifications examined, exclusive of Philadelphia's, the force-account method of paying for extra work is first choice with eight, second choice with thirteen, third choice with seven, and fourth choice with two. Fourteen make the unit prices bid by the contractor their first choice; one uses fixed prices in the specifications as its first choice; five choose first the special unit-price agreement, and one the lump-sum method. By using force account only where other methods are impracticable, Philadelphia's practice conforms, therefore, to the practice as shown by the majority of specifications studied.

Force-Account Practices.—While the force-account method has advantages, it must be kept under rigid control, and must not be too attractive. Otherwise the advantages of elasticity and flexibility become disadvantages.

Force account is subject to abuse. The inexperienced engineer may take the easier method of using force account for work which is quite susceptible of classification and appraisal. In so doing he will increase the need of field supervision, render costs uncertain, and open the way for undue expansion of this class of work. And the contractor may endeavor to expand the volume of work to be done on a force-account basis if it affords him an attractive profit.

Reference has already been made to an examination of the specifications of a number of cities which use force account. The rest of this report is devoted to a statement of the more important force-account practices observed in the specifications studied, and a comparison of these practices with those used in Philadelphia.

Fixing the Percentage.—It is an almost universal custom with engineers to state in the specifications what percentage of direct cost will be allowed for force-account work. In Philadelphia the bureau of engineering has been using this method. The department of city transit has used the method on some contracts, but on others (North Broad Street subway contracts No. 101, 102, 110, 107A, and 107B, for examples) the contractor was required to bid the percentage. The percentage bid by the contractor worked into the contract price as follows: An estimated amount of force-account work was named in the specifications. Application of the percentage bid by the contractor to this estimate resulted in a figure which was added to the amounts bid on unit-price work and the total thus arrived at was the contractor's bid, used in comparison with other bids to decide which was the lowest.

The practice was illogical because the estimated amount of force-account work was entirely speculative. If it had not been, the work could have been included in the schedule of unit prices. Force-account work is, or should be, unforeseen or emergency work. Hence any estimate of it in advance introduces a fictitious item into the bidding.

Obviously this method gave little assurance that the city would find the best bidder. It might easily happen that the contractor submitting the lowest bid for the job originally would be the most expensive in the end because of a high percentage on an amount of force account much larger than was anticipated. "Bidding the percentage" on force account therefore opens the way for an "unbalanced bid." A contractor may have special familiarity with local conditions which enables him to foresee that more force-account work will be required than was estimated by the city's engineers. He can bid a high percentage on force account and a low unit price on another item, thus keeping down the bid which is to be compared with other bids, but relying on a neat profit on the increased expenditure for force account. The practice would tend to place out-of-town contractors at a disadvantage, because the local contractors, having superior knowledge of the conditions, would be able to approximate more closely the actual amount of force-account work needed.

In the course of this study it has not been discovered that the practice of estimating the amount of force-account work and requiring the contractor to "bid his percentage" has been used anywhere but in Philadelphia. There seems to be no good reason for perpetuating this unusual custom, and very good reasons for abandoning it. The department of city transit has evidently been fully alive to the objections to the practice, which was introduced in its earlier days, and has been emancipating itself from it in its minor contracts. It recently cast it overboard altogether on a major contract, having specified 15 per cent on the costs of labor, materials, and liability insurance in its South Broad Street subway specifications.

Percentage Provisions.—The specifications of the bureau of engineering dealing with force account provide that—

(a) For all labor, teams and foremen in direct charge of the specific operation, the contractor shall receive the current local rate of wage, to be agreed upon in writing before starting such work, for each and every hour that said labor, teams and foremen are actually engaged in such work, to which shall be added an amount equal to fifteen per centum of the sum thereof.

(b) For all materials used the contractor shall receive the "actual cost" of such materials, including transportation charges, as shown by original receipted bills, to which cost shall be added an amount equal to ten per centum of the sum thereof.

(c) For machinery, power tools or equipment, including fuel, lubricants, operating tools, repairs and replacements which it may be . . . necessary or desirable to use, the engineer shall allow the contractor a reasonable rental price, to be agreed upon in writing before such work is begun, for each and every hour that such tools or equipment are in use on such work, and to which no percentage shall be added.

Current specifications of the department of city transit, as they appear in contract 109 for the South Broad Street subway, provide that "payment under force account will be made on the actual net direct expenditure for material, labor, and employer's liability insurance, plus 15 per cent."

Variations as observed in the specifications just quoted are common to all the specifications examined. No effort has been made to standardize these items, although it seems that there would be advantage in so doing. From the following, however, it will be seen that Philadelphia's practice is not abnormal in respect to the costs upon which a percentage is allowed.

In the 30 specifications of other cities embraced in this study, cost plus a percentage is paid on labor. Twenty-six pay cost plus a percentage on materials; four pay cost only.

On plant rental, six pay a percentage; twelve pay rental without a percentage, while six pay no rental, but include plant costs in the percentage. Six do not touch upon the subject. Further consideration is given to plant rental in a subsequent section of this memorandum.

A percentage is given on the cost of insurance on labor by seven. Eleven pay insurance cost only. In eight, the insurance is to be included in the percentage, while four do not refer to insurance. It is noteworthy that, although the department of city transit allows employer's liability insurance, plus 15 per cent, the specifications of the bureau of engineering do not mention insurance either as an item of cost to be allowed with or without a percentage or as something for which the percentage compensates the contractor.

What Percentage Pays for.—Generally speaking, of course, the percentage is intended to compensate the contractor for the items of cost which are not specified as being chargeable to the city, together with a profit. If, for example, insurance costs cannot be charged to the city, the percentage on items which can be charged must be supposed to compensate the contractor for it. However, specifications usually name some or all of the items which the percentage is to cover. Thus, in the specifications of the Baltimore city water department, it is provided that the "actual cost" of force-account work "shall not include the use of tools nor general superintendence, nor office accounting or engineering expenses, nor any allowance or percentage for collateral or estimated costs, nor any profit," all of which is deemed to be included in the specified 15 per cent allowance.

The Salt Lake City paving specifications provide "20 per cent for supervision, overhead, insurance, profit, etc.," while the New York board of water supply in the Gilboa dam specifications requires that "10 per cent shall be considered as covering administration, general superintendence, profit, and all other expenses not included in the net cost."

Pittsburgh's general construction specifications provide that no "interest, rent, depreciation of plant, service of general superintendent, or administration force" shall be included, the allowance of 15 per cent including all such expenses, profits, and contingencies. In Milwaukee, the 15 per cent covers "administration and clerical expenses, supervision and superintendence above foreman; . . . cost, use or upkeep of tools, plant and machinery and rent of storage yard."

Philadelphia specifications are much the same as the foregoing. The compensation allowed by the bureau of engineering is to be accepted by the contractor as full payment for additional work done on a force-account basis, and "shall include superintendence, use of hand tools and equipment necessary to the work for which no rental is allowed, and profit on the work." In the department of city transit the percentage is to compensate the contractor for "superintendence, the furnishing and use of tools, plant and equipment, overhead and profit."

It is believed that the bureau of engineering should allow workmen's compensation insurance as an item of cost chargeable to the city. Whether a percentage should be allowed on it in addition may be left an open question. To allow the insurance, plus 15 per cent, would bring the practice of the bureau of engineering into conformity with that of the department of city transit.

The premium on the surety bond covering the contract is not mentioned in Philadelphia specifications, either as an item of cost to be allowed or as an item for which the percentage compensates the contractor. This practice seems justifiable, provided the contractor does not have to pay an additional surety bond premium for the force-account work. If the force-account work involves an additional premium for the contractor, he should be allowed to charge it to the city. Similar considerations would apply to the penal bond.

What Percentage?—It has been seen that the department of city transit pays a straight 15 per cent, while the bureau of engineering pays 15 per cent on labor and 10 per cent on materials.

Richmond, Virginia, pays a straight 12 per cent. On the Gilboa dam, 10 per cent is paid. Saginaw and Flint, Michigan, Salt Lake City, and Santa Fe, pay 15 per cent on labor and 10 per cent on materials. San Francisco pays 10 per cent on the cost of materials going into the work, premiums for workmen's compensation insurance, and the cost of labor, including foremen, with an additional 10 per cent on the cost of labor and its percentage. All the other specifications studied allow a straight 15 per cent.

Rental of Plant.—As previously stated, some specifications provide for rental of plant and equipment with a percentage, some for rental without a percentage, some for compensation for the plant out of the percentage on other items, and some do not mention plant rental.

If machinery or power tools, teams and horse-drawn equipment are re-

quired, they should be employed on an hourly rental basis. The rental should include power, fuel, lubricants, and maintenance. If repairs and replacements are allowed, the plant should be carefully inspected before being put to work and a record made of its condition. It simplifies bookkeeping to include machine operators and drivers in the hourly rental price. It appears best to include a profit in the rental price.

The specifications of the bureau of engineering provide a reasonable rental, without percentage, for machinery, power tools, or equipment. This seems the best practice. The specifications of the department of city transit are less satisfactory. They make no provision for rental of contractor's plant and equipment in force-account work, this being included in the percentage.

Repairs to Plant.—The subject of repairs to the plant used on force-account work is referred to in but few of the specifications coming within the scope of this study. It is a matter upon which opinion seems to be divided. Of the specifications referring to it, some allow repairs and others state that no allowance will be made. If repairs (as distinct from maintenance) are not allowed, it would seem only good business on the part of the contractor to add something to plant rental to cover breakage or damage incurred exclusively on this work. If repairs are allowed, there is an opportunity for an unscrupulous contractor to charge for repairs properly chargeable to other jobs. A definite clause covering this matter would, however, prevent uncertainty as to the city's stand, and the elimination of uncertainty at every possible point should be the aim of every engineer. In Philadelphia, the bureau of engineering seems to be the only one touching upon this point in its specifications, the cost of repairs and replacements being included in the rental price.

City Materials.—Should the municipality be able to purchase cement or cast-iron pipe or other construction material at a price lower than can be obtained by contractors, it will probably be to its advantage to furnish these to the contractor. This right is reserved in various specifications, usually with the additional provision that no percentage shall be paid upon the material so furnished.

It seems desirable for the city to reserve the right to furnish the material. Whether a percentage should be allowed on it should, perhaps, be considered an open question.

Part of the Contract.—The specifications should make it clear that extra work, including force account, is an integral part of the job covered by the contract and subject to all the conditions thereof, thus directing the contractor's attention to his acceptance of all regulations controlling the subletting, abandonment, neglect, or unreasonable delay of work; carelessness or bad faith; materials, workmen and workmanship; superintendence, payments, suits, claims, and the responsibility for accidents leading to loss of life or destruction of property.

All forces engaged on force-account work should be as fully insured as on unit-price work. When the amount of force-account work is small, forces are usually simply transferred from the unit-price work. Whether transferred or specially employed, they should be fully covered by workmen's compensation insurance.

Not only should specifications include as part of the contract all extra work properly belonging to it, but they should also make it clear that extra work which does not properly belong to it is not to be charged to it. Charging one contract with extra work which belongs to another is a possibility when the contracts are adjacent. The provision in the specifications of the bureau of engineering that the contractor shall "do such additional work . . . as may be necessary . . . to fully complete the work as planned and contemplated," is probably adequate to exclude work not a part of the job.

Limiting the Amount.—In the specifications of some cities the amount of force-account work is restricted. The board of transportation of New York City limits the total amount which may be paid on force account for work and materials to 2 per cent of the total contract price, and no expenditure in excess of $50,000 is binding upon the city until approved by the board of estimate and apportionment. Under the Gilboa dam contract of the board of water supply of New York City, not more than 5 per cent of the estimated amount of the contract price may be spent on force-account work. New Orleans restricts the amount which may be spent in this manner on her paving contracts to $500.

No other city coming within the scope of this study, including Philadelphia, makes such restrictions. They are, however, strictly in accord with the thought of placing force-account work under reasonable control, and on large contracts they seem especially desirable.

On small contracts it might be sufficient to provide in the specifications a limit upon force account beyond which it would be unlawful to go without approval of the director of the department. This would be effective as a device for making it certain that the extent of the force-account work came to the attention of the department head. Limits upon the power of the department to have work done on force account would, of course, have to be imposed by an authority higher than the department. They could be imposed by the city council.

When the amount of extra work is very large, it should be done by a method other than force account—preferably under a separate contract in which all the elements have been discussed and reduced to writing.

Written Order Required.—Specifications ordinarily stipulate that no work shall be paid for except upon a written order signed by a designated official, usually the chief engineer or his accredited representative. Frequently a counter signature is required, as that of the director, the commissioner, or other official. This tends to preclude any possible ambiguity or misunderstanding about the amount or kind of work to be done. A written order is more likely than an oral one to express clearly the requirements and limitations of the work to be done, a thing always desirable when the expenditure of money is involved.

The engineer, however, should have the authority to issue and the contractor to receive oral authorization for extra work in case of emergency, to be confirmed by the written order within 24 hours.

In Philadelphia the specifications of the department of city transit for the South Broad Street subway provide that "no work nor material will be paid for under force account unless it be ordered as such in writing by the chief engineer." The specifications of the bureau of engineering, for main and branch sewers, provide that "the engineer, with the approval of the director, may order such work done on a force-account basis" and that prices are to be agreed upon in writing, but there is no provision requiring written authority for beginning force-account work.

Written Agreement on Costs.—An oral agreement, or one evidenced by an informal memorandum made by an engineer in the field, to pay the contractor the current local rate of wage for labor or a rental for machinery in manifestly a rather loose method, particularly when large amounts of labor or machinery are involved. The specifications of the bureau of highways, department of public works, Baltimore, Md., are more precise. They provide that:

For all labor, teams, trucks, and foremen in direct charge of the specific operation, the contractor shall receive the current local rate of wage, to be agreed upon in writing before starting such work.

For any machine power tools or equipment, including fuel and lubricants, which it may be deemed necessary or desirable to use, the engineer shall allow the contractor a reasonable rental price, to be agreed upon in writing before such work is begun.

In Philadelphia the specifications of the bureau of engineering, department of public works, require a written agreement on rates for labor, teams, and foremen before force-account work is begun. The specifications of the department of city transit require costs to be approved by the engineer, but do not state that they must be approved before the work begins.

There are other phases of the question covered in the report, but space does not permit more than mention of the fact that special time sheets are advisable on a job to show labor on force account, that it is well to make payments on force-account work at the same time as payments are made on contract, having the contractor present itemized bills monthly in time for the monthly estimate and that several specimen contracts provide for extensions of time in case of unavoidable delays on the work.

Summary.—The Bureau of Municipal Research submited the following summary of conclusions and recommendations, based upon the analysis of methods of paying for extra work, particularly the force-account method, made in the report:

1. The specifications should be truly specific and should be standardized as far as practicable. Every point which, so far as can be foreseen, may raise a question between the contractor and the engineer during performance of the contract, or in the mind of the contractor at the time of making his proposal, should be covered in the specifications. Standardization of specifications—that is, uniformity with other cities—is, of course, not a matter solely within the city's control. However, officials should take advantage of every opportunity to promote uniform specifications. Completeness and uniformity of specifications should encourage bidding, especially by out-of-town contractors, by reducing the necessity of guarding against surprises which may otherwise be encountered during the course of the work.

2. Extra work probably cannot be avoided on major constructions, and provision should be made for it in the specifications.

3. A schedule of fixed prices for extra work is of doubtful utility for the reason that if the kind, quantity, and cost of the work (all of which must be known in order to fix prices intelligently) can be foreseen, it would be better to provide for the extra work in the schedule of items and unit prices; and if they cannot be foreseen, any figures prepared by the engineers must be guesswork, which is contrary to the whole theory and intent of the specifications.

4. It would seem best to use force account only where other methods of paying for extra work are impracticable. Other methods should, therefore, be provided for in the specifications; but force account should also be provided for in the event that the other methods are found impracticable.

5. The percentage to be allowed on force-account work should be fixed at a reasonable rate stated in the specifications.

6. The items on which the percentage is allowed and the items for which the percentage is meant to compensate the contractor should be stated in the specifications.

7. The specifications should provide for the rental of plant, equipment, and power tools at prices to be agreed upon in writing, and should state how plant repairs are to be taken care of. No percentage should be allowed on rental.

8. Extra work should be expressly made a part of the contract, subject to all the conditions of it, especially those referring to insurance, and the fixing of responsibility for accident.

9. On large contracts the amount which can be spent on extra work should be limited to some percentage of the contract price and a sum should be set beyond which payment for extra work cannot be made without additional authorization.

10. It may be desirable at times for the city to furnish materials for construction. The specifications should therefore reserve this right.

11. Except for work done in emergencies, claims for force-account work should not be valid unless based on written orders, and costs should be agreed upon in writing before work is begun.

12. Specifications should provide for daily checking of time sheets by representatives of the contractor and the engineer and for the filing of the sheets in their respective offices.

13. Payments for extra work should be made monthly and should be based on monthly statements made by the contractor.

14. Specifications should give the contractor the right to an extension of time for the completion of a contract delayed by the necessity of doing extra work.

Municipal Airport Construction

The following figures from June Concrete Highways and Public Improvements shows the municipal airport developments in a number of representative cities:

Baltimore—Pop. 819,000—bond issue passed in 1927, $1,500,000.

Buffalo—Pop. 550,000—expenditures to date $1,000,000.

Cleveland—Pop. 984,500—bond issue approved $1,250,000.

Dallas—Pop. 211,600—bond issue approved in 1927 $400,000.

Dayton—Pop. 180,700 bond issue for improvements $250,000.

Lincoln, Neb.—Pop. 62,000—passed bond issue $100,000.

Newark—Pop. 466,700—for immediate construction $1,250,000. Complete development will be $6,000,000.

New York—Pop. 5,970,800—site approved, Feb. 1928. Appropriation for preliminary work $500,000.

Oakland, Cal.—Pop. 267,300—expenditure during 1927 $1,000,000.

Portland, Me.—Pop. 76,400—1927 expenditure $100,000.

Portland, Ore.—Pop. 258,288—expenditure reported $1,250,000.

San Diego—Pop. 115,300—bonds approved Nov. 1927 $650,000. Additional plans for municipal and naval use $1,156,000.

Seattle—Pop. 375,300—expenditures to date $125,000. Development calls for $2,000,000.

San Francisco—Pop. 576,000—for preliminary work $1,000,000.

St. Paul—Pop. 250,100—preliminary work $250,000.

Sewage Research Laboratory Established at Texas College

The Engineering Experiment Station of the Agricultural and Mechanical College of Texas, College Station, Texas, has recently established a laboratory for sewage research. The work planned will include studies of sludge digestion, utilization of sludge, action of filter beds and stream pollution. Special attention will be given to problems peculiar to Texas and the Southwest. Extensive remodeling of the two sewage disposal plants of the college has been done to aid the research work.

The work will be under the general supervision of Dr. F. E. Giesecke, Director of the Engineering Experiment Station. E. W. Steel, Professor of Municipal and Sanitary Engineering, will direct the investigations. P. J. A. Zeller, formerly chemist with the New Jersey Sewage Experiment Station, has been appointed Research Associate. The personnel of the Agricultural Experiment Station, which is also located at the A. and M. College, will cooperate in the studies of use of sludge as a fertilizer.

Rear Yard Requirements for Dwellings and Apartment Houses of Cities Having Housing Codes
Compiled by Jessie May Short of Reed College, Portland, Ore.
Minimum Requirement in Feet, Based on 50x100-Ft. Lot

Name of City	Corner Lot—Number of Stories						Interior Lot—Number of Stories					
	1	2	3	4	5	6	1	2	3	4	5	6
Berkeley	10	10	10	15	20	25	10	10	10	15	20	25
California	10	10	10	10	10	10	10	10	10	11	12	13
Columbus	15	15	15	15	15	15	18	18	18	18	18	18
Detroit	10	12	14	16	20	24	10	12	14	16	20	24
Duluth	12	14	16	18	20	22	12	16	16	18	20	22
Indiana	15	15	15	18	21	24	25	25	25	28	31	34
Iowa	10	12	14	16	18	20	10	12	14	16	18	20
Louisville	12	13	14	15	16	17	12	13	14	15	16	17
Michigan	10	12	14	16	20	24	10	12	14	16	20	24
Massachusetts	15	15	15	20	25	30	25	25	25	30	35	40
Minneapolis	15	15	20	25	30	35	15	15	20	25	30	35
Minnesota	20	20	22.5	26.5	29.5	31.5	20	20	22.5	26.5	29.5	31.5
Sioux City	10	12	14	16	18	20	10	12	14	16	18	20
Average	12.6	13.5	14.8	17.3	20.2	23.0	14.4	15.2	16.7	19.3	22.1	24.9

Methods of Water Treatment at Chain of Rocks and Harvard Bend Plants, St. Louis

A Paper Presented Jan. 24 at Texas Water Works Short School

By L. A. DAY
Water Commissioner, St. Louis, Mo.

THE present water supply is obtained from the Mississippi River at the Chain of Rocks—about ten miles north of the center of St. Louis. The river water enters our plant through two intakes, one, the old or west intake, 1,500 ft. east of the west bank of the river and connected to the wet well by a 7-ft. circular, brick-lined tunnel, 2,197 ft. long. The other or east intake is 700 ft. east and 200 ft. north of the west intake and is connected to the wet well by an 8-ft. circular, concrete-lined tunnel, 2,747 ft. long.

The water entering the tunnels flows by gravity to the wet well, whence it is pumped, against a dynamic head of 58.3 ft. into the delivery well, and flows from there to the grit chamber where the average velocity of flow, at a rate of pumping of 150,000,000 gal. per day, is only 0.33 ft. per second, the retention period being 7.5 minutes.

In this chamber the coarser and heavier part of the suspended matter is deposited, the amount removed depending upon the character of the suspended matter as well as upon the amount present in the water. The coefficient of fineness of the suspended matter during the past ten years has varied from 0.98 to 1.56 and the amount of suspended matter removed by the grit chamber has varied from 9.0 to 32.0 per cent.

Application of Chemicals.—Leaving the grit chamber, the water flows through a short conduit to the mixing conduit, where milk of lime and a solution of sulphate of iron are added. These chemicals are prepared in the coagulant house for addition to the water and are pumped 900 ft. to the mixing conduit.

The lime is weighed out in automatic scales and is dumped into circular slaking tanks which are provided with revolving rakes. The temperature of the milk of lime is maintained at 200 deg. F. The hot milk of lime overflows the slaking tank into a heater tank and passes through a number of boiler tubes around which circulates the water that is used in slaking. In this way the temperature of the slaking water is increased 30 deg. to 50 deg. F., and the heat produced by the slaking of the lime is sufficient to maintain the milk of lime in the slaking tank at 200 deg. F. From 4 to 4½ lb. of water per lb. of lime are used in slaking. The milk of lime from the heater tank is run into a cooling and diluting box, where the temperature is reduced to as low as 64 deg. in winter, to 180 deg. in sumder. The strength of the milk of lime as pumped is 38,600 parts per million of calcium oxide.

The Mixing Conduit.—The mixing conduit into which the chemicals are delivered is a reinforced concrete box, 2,382 ft. long, 32 ft. 1 in. wide and 12 ft. 6 in. high, divided longitudinally into four compartments, each 7 ft. wide and 11 ft. high. The four compartments are supplied with stop-plank openings so that they be used in parallel, series or withdrawn from service for cleaning.

In normal operation the water enters the two west channels and travels the full length two times, a total of 4,764 ft., having an average velocity of 1.65 ft. per second when the rate of pumping is 150,000,000 gal. a day. Provision is made so that the lime or iron may be added to either of the four compartments, but the lime is added, for the greater part of the time, to the raw water as it enters the mixing conduit and the sulphate of iron as it leaves the conduit. The period of mixing averages about one hour.

The Coagulation Basins.—After passing through the mixing conduit, the water enters the first of six coagulation basins, each 400 ft. long by 670 ft. wide, of 30,000,000 gal. capacity. The first three division walls have five stop-plank openings, and the last two, four openings, all 4½ ft. deep by 8 ft. long. These openings render the coagulation basins less efficient than would weirs extending the full width of the basins, but because of the necessity of maintaining an elevation of water but little lower than the top of the basins, the need of stop-plank openings at times of cleaning is apparent. The time of sedimentation, based upon the capacity of the basins, varies from 30 to 43 hours, but the actual time is much less, the effects of a change in the amounts of chemicals added being noticeable in 12 to 15 hours in the last of the basins. About 90 per cent of the suspended matter and bacteria are removed in the first basin and 9 per cent in the remaining basins.

Removal of Mud.—The total amount of matter removed from the water during the past year, including the chemicals added and the dissolved solids removed, amounted to 270,861 tons. Some of the mud was removed by opening the sewer gate for one-half hour at varying intervals, but the greater part was removed from the basins by labor and tractors. The tractors are equipped with bulldozers which cut off portions of the mass of mud and push them to the central gutter, through which water is flowing. The men are provided with scrapers which are used to remove the mud from the sloping sides of the basins and to clean up after the tractors. The cost of the removal of the mud from the sedimentation basins, including the cost of the water, was 5.0 ct. per cu. yd. for the past year, 1.74 ct. for labor and 3.26 ct. for water.

Secondary Coagulation Basin.—The water leaving the coagulation basins enters a collecting conduit and passes through two 8-ft. Venturi meters and into a small secondary coagulation basin, connected to two larger coagulation basins by stop-plank openings. The solution of sulphate of alumina is added at the throat of the meters and is automatically controlled so that the quantity added per unit is constant for any setting, regardless of fluctuations in the flow through the meters.

No mixing chamber is provided here because of the low permissible loss of head, namely 1½ ft. There are two secondary coagulation basins, one east of the filter plant and one north, each of which is connected to the influent flume of the filters. The time of reaction and sedimentation, based on capacity, is twelve hours with both basins in service and six hours with one. The water entering the secondary coagulation basin has a turbidity less than 25 parts per million as an average.

Secondary coagulation has been practiced at this plant since the filters were put into service in 1915. When a turbid water is treated with enough lime to produce considerable softening and sulphate of iron is used as a coagulant, it will be found that when the water is clear enough to be placed on the filters, that no floc is left in suspension. It is necessary to provide a floc by adding a secondary dose of coagulation if successful operation of the filters is desired. Aluminum sulphate is used as the secondary coagulant and decided reduction in the normal carbonate alkalinity results.

The reduction in total alkalinity from the use of 1.41 gr. per gal. was 13

p.p.m. and the normal carbonate alkalinity was reduced from 48 to 17 p.p.m. This action of aluminum sulphate also prompted the use of a secondary coagulant. The value of secondary coagulation may be seen by a study of the results shown in our annual reports.

The Filter.—The water entering the filter plant is passed through 49 filters, each with a filtering area of 1,400 sq. ft., or 4,000,000 gal. capacity. The filtering media consist of 30 in. of sand above 12 in. of graded gravel. The effective size of the filter sand as placed in the filters was 0.341 mm., with a uniformity coefficient of 1.81. The effective size has increased to 0.45 due to the coating on the sand grains as a result of the use of lime for softening.

Chlorination. — For the past two months chlorine has been added to the settled water entering the secondary coagulation basins. Enough is added to maintain a slight amount of free chlorine in the water passing on to the filters. A decided reduction in the number of bacteria results from the treatment and thus an added factor of safety is provided by rendering the effluent from the filters safe for consumption without the use of extra chlorine, although chlorine is added to the effluent to maintain 0.2 p.p.m. residual chlorine five minutes after the final dose. The total amount of chlorine necessary to maintain the desired residual is but slightly greater than if the entire amount were added to the effluent.

Howard Bend Plant.—The new water works is located about 17 miles west of the St. Louis Court House on the Missouri River. The water will enter a shore intake through any of 15 gates, pass into five chambers, each chamber having three gates. The chambers are so connected that the water entering any gate may be drawn into any chamber, each chamber being equipped with a traveling screen to prevent the entrance of debris into the pumps.

The Low Service pumps will deliver the water into two primary clarifiers, each 150 ft. square with a working capacity of 2,500,000 gal. The water will enter each unit through five 2-ft. x 3-ft. gates, spaced 30 ft. on centers into a stilling box 3½ ft. wide and then through 100 2-in. x 8-ft. 6-in. slotted openings spaced 1 ft. 6 in. on centers. The water will be drawn from the basins through similar slotted openings, into a stilling box and then through the gates. The velocity through the clarifier will be 1.2 ft. per minute and the detention period 2 hr. 10 min. at 55 m.g.d. Although the raw water entering these clarifiers will sometimes be as great as 10,000 parts per million, it is expected that the effluent from the clarifiers will rarely exceed 500 p.p.m.

Mixing Conduit and Tanks. — The water leaving the primary clarifiers will pass into a primary rapid mixing conduit made up of sections, 10 ft. high by 5 ft. 6 in. in width, five 180 deg. and one 90 deg. rounded turns being provided. The full length flow through the conduit will be 170 ft. The velocity at 55 m.g.d., will be 1.55 ft. per second and the detention period 1 minute 50 seconds. The milk of lime prepared in the coagulant house will be added as the water enters the conduit and the sulphate of iron as it leaves.

The water will pass from the mixing conduit into two circular mixing tanks, each 65 ft. in diameter with a working capacity of 292,000 gal. The water will be introduced tangentially at the top and be taken off at the center bottom. Each unit is designed for a maximum capacity of 16 m.g.d. and at this rate the mean velocity will be about 0.6 ft. per second and the detention period will be 26 minutes. The entrance velocity may be increased by decreasing the size of the entrance conduit.

Secondary Clarifiers and Coagulation Basins.—From the circular or tangential mixing tanks, the water will go to the secondary clarifiers. The velocity and detention in these clarifiers will be the same as in the primary. It is expected that the water leaving these clarifiers will usually have a turbidity of less than 200 parts per million, the amount of sulphate of iron calculated to produce this effluent being 3-8 grain per gallon.

After leaving the secondary clarifiers, the water will enter two coagulation basins each 406 ft. x 330 ft. The working capacity of each basin will be 15,000,000 gal. and the basins will be operated in parallel. The manner of entrance and egress of the water will be the same as in the clarifiers except that the gates will be spaced on 40-ft. instead of 30-ft. centers. The velocity of the water through the basin at a 55 mgd. rate will be 0.396 ft. per minute and the detention period will be 13 hours. It is expected that the turbidity of the water leaving these basins will not exceed 5 parts per million.

Chemical Feed.—All of the chemicals will be prepared in the coagulant house and the solutions will flow by gravity to the mixing conduit. The chemicals will be weighed in Richardson automatic scales which will dump at set periods on to a moving belt. The speed of the belt and the time of dumping will be so controlled that a steady stream of coagulant will be fed into the dissolving boxes. The lime will be fed into slaking tanks similar to the ones now in use at the Chain of Rocks. All chemicals will be unloaded and placed in storage by means of a vacuum system.

The water will flow from the coagulation basins to the carbon dioxide charging basin, 110 ft. long, 41 ft. wide and 18 ft. deep, with a baffle running through the basin. The method of distributing the carbon dioxide has as yet not been decided upon. The working capacity of the basin will be 533,000 gal., the velocity about 15.6 ft. per minute and the detention period 14 minutes 10 seconds at 55 m.g.d. The carbon dioxide will be obtained from the flue gas, bituminous coal being the fuel employed.

From the carbon dioxide charging basin, the water will pass through a secondary rapid mixing conduit similar to the one already described except that the length of travel and velocity will be slightly less. The aluminum sulphate will be added as the water enters this conduit.

Secondary Coagulation Basin.—From the mixing conduit, the water will flow through the secondary coagulation basin, 90 ft. long, 159 ft. wide, with 7 baffles 70 ft. long making channels 19 ft. wide. The velocity at 55 m.g.d. with the channels operated in series will be 0.37 ft. per second and the detention period 32 minutes. The aluminum sulphate will be thoroughly mixed with the water in the mixing conduit and the slower flow with the gentle mixing accomplished by the around the end baffles for over half an hour should yield maximum results. The basin is so arranged that the channels may be used in parallel or may be by-passed. The time that the water will remain in this basin precludes any sedimentation so that the amount of turbidity and aluminum sulphate must be at a minimum.

The Filters.—The water leaving the secondary coagulation basin will pass on to 20 filters, each of 4 m.g.d. capacity. These filters will be quite different than those at the old plant. Instead of having a central trough, separating the filters into halves, the filters will have a trough on both ends. Two sewer and two influent valves will be necessary for each filter. Instead of the ridge block with bronze strainer as installed at the old plant, the strainer system will consist of cast iron pipe spaced 1 ft. on centers, 50 to a filter. The pipe varies from 4 in. at the center to 3 in. at the end, welded so as to make a smooth joint. The size of the holes in the pipe is 3-8 in. The effluent pipe varies from 8 in. at the back of the filter to 2 ft. 9 in. at the discharge end.

There will be 18 in. of graded gravel and 20 in. of sand over the manifold. The effective size of the sand will be 0.42-0.47 mm. and the uniformity coefficient not to exceed 1.65. Instead of river sand graded in the filter as was used at the Chain of Rocks, graded Ottawa sand will be used.

The height of the water over the sand will be approximately 8 ft. so that the filters will rarely operate under negative head.

Chlorine will be added to the effluent, the chlorine being measured by Wallace-Tiernan pedestal type machines, the cylinders being placed on chloroscales which will record the amount of chlorine being used.

New Development for Increasing Efficiency of Old Plant.—The following are improvements or new developments

to increase the efficiency of the old plant:

The shore intake offers the great advantage of being accessible at all times and there is no long tunnel to construct and to be filled with sand and gravel when in service. At times of ice trouble, when the river is full of floating ice, it is impossible to get to the intakes at the Chain of Rocks and we do not feel justified in maintaining the number of men at the tower that are needed when real ice trouble is experienced. Means of taking care of any trouble experienced in an intake are readily available at a shore intake.

The primary clarifiers will remove not only the sand as is done in a grit chamber, but will also remove the greater part of the mud with the added advantage of continuously removing the mud from the clarifier with a minimum of water waste and the settling capacity of the clarifier not reduced by solid and floating mud.

The mixing conduit with its rounded turns and high velocity should insure a thorough mixing of the chemicals with the water and thus leave much less work to be done in the circular mixing tanks. The flow in the tanks will not be violent but sufficient turbulence will be created to allow good floc formation.

The slotted openings into the basin will yield much better results than the openings in the weirs as at the Chain of Rocks. The slots are nearly one-half the depth of the basin and with the expected equal distribution of the water through the slots and the depth of water in motion, the detention period of the water in the basin should approach the theoretical detention.

The sludge removed from the secondary clarifiers will be used to hasten the reaction of the chemicals added to the water and some will be added to the raw water entering the primary clarifiers. A more thorough action should result and a saving in chemicals should be effected.

The carbonation of the water will eliminate the coating on the filter sand and also stop the deposition of coating upon the service pipes throughout the city.

The filter sand at the Chain of Rocks is Mississippi River sand graded in the filters. As a result of this method of grading, the effective size of the sand in the various filters varied from 0.31 to 0.45 mm. The sand in the filters being graded sand at the new plant, there should be but little variation in the size.

The greater positive head that will be available at the new plant will enable the filters to be operated without the packing and breaking of the filter bed due to filtering at considerable negative head.

The cast iron pipe manifold strainers and the tapered underdrain should give a much better distribution of the wash water than is obtained with the ridge block strainers at the old plant. Trouble from broken U bolts, loose strainers and clogged holes in the strainer plates is considerable.

The filters will be equipped with a device that will permit the opening of the controller valve to any desired rate in any time up to one hour. From a great many experiments made at the Chain of Rocks we found that by this means the amount of turbid water passing the filter after washing will be considerably reduced.

The large storage provided, 100,000,000 gal., will make it possible to operate the plant continuously at the same rate and thus avoid the disturbing influences of frequent changes of rate.

Contractor Pays City for Park Fill

It is unusual for a city to get any of its park development work done for nothing. Still more unusual is it for contractors to come hat in hand to the city authorities and offer to pay them for the privilege of helping to build a park. That seems to be what is happening just now along the Hudson River waterfront north of Seventy-second Street, in New York City. The city wanted this land filled in and saw its opportunity in connection with the excavation of the Eighth Avenue subway. It arranged with the contractors, who were naturally glad to have so handy a dump, to cart their rock and dirt to the river front. Apparently they did not pay very much attention to grading. Mountains were built here and there, not particularly serviceable for ultimate park purposes, and chasms intervened with no fill at all.

Now the engineers of the Board of Transportation have entered into a new contract with these singular terms: instead of the city paying to fill in and level off the newly made land, the contractor is to pay the city $60,000 for the privilege. He is counting on getting his money back from all manner of individuals who have been doing a little excavating on their own. The arrangement appears to be that these private excavators will pay the general contractor fifty cents a truckload for the privilege of dumping their dirt on the river bank. Out of that sum he will pay thirty cents to the city. The remaining twenty cents is expected to cover his profits and the cost of having the filled-in land graded in accordance with the plans and specifications of the Park Department.

The present undertaking is limited to the work of filling in and grading. Once that is done, the Park Department will carry on with the scheme for beautification. Eventually the development of this section of the waterfront must be harmonized with the general west side improvement plan, which is moving slowly forward. Before he went to Houston Mayor Walker, in response to emphatic public demand, appointed a committee to give proper consideration to the architectural and landscape features of the project. Among its members are Park Commissioner Herrick and such recognized authorities as Joseph H. Freedlander, architect, and Herman W. Merkel, the landscape architect who recently drew up the plans for rehabilitation of Central Park. This committee, the engineering committee and the various city departments concerned will all have a hand in the ultimate solution of the west side problem, so long delayed.—New York Times.

City Sweepers Organize

Election of officers and trustees, and the appointment of committees on organization featured the first regular meeting of the newly founded Drivers, Sweepers, Hostlers, Stablemen and Section Station Keepers Benevolent Association, Inc., composed of workers in the Department of Street Cleaning, at Pearl Mansion, 98 Forsyth Street, New York City.

Officers elected for one year are: John Nacero, President; Jacob Abrams, Vice President; Gerardo Guglielmo, Financial Secretary; David S. Noe, Recording Secretary; Harry Yudenfrient, Treasurer.

Pasquale Sturccio, Angelo Marabella and Ferdinando Ragonese are Trustees, with Jack Casaccio, Sergeant at Arms.

Thomas R. Fitzgerald, a former department employee, set forth the aims of the new organization. He demanded a return of the eight hour day, asked for a maximum requirement of twenty years of service for pension eligibility, with yearly reports and representation of the workers on the pension board, and suggested a clearer definition of the duties of street cleaners.

Other speakers were Morris Echenbaum and Jacob Kusch, organizers of the new body.

Regular meetings will be held on the first and third Sundays of the month.

Creation of Tree Board Proposed

Establishment of a shade tree commission for West Orange, N. J., was advocated by the Planning Commission to the Town Commission at a recent meeting of the Commission. The planning board said the necessity for the unit was emphasized by the ignoring of recommendations to plant trees in many developments.

Mayor Rollinson declared the Planning Commission is already over-burdened and it is too much to charge it with the responsibility of shade trees. The Planning Commission, through its secretary, Frank Jay Morris, declared only one developer has given cognizance to suggestions about tree planting.

The Economic Side of Sewage Disposal

Paper Presented at Iowa Sewage Treatment Conference

By N. T. VEATCH
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THERE may be a question on the part of some as to whether or not sewage disposal has an economic side, especially to water works operators. The fact that in a large majority of cases, sewage disposal is carried on as a non-revenue producing utility, and in fact generally requires continual outlay for operating costs, repairs, etc., has no doubt had a tendency to give the general public the impression that it is a necessary evil, to be borne in the easiest way possible. Generally speaking, little if any thought has been given to the economic side of sewage disposal. The purpose of this paper is to outline in the brief time available, some of the pertinent facts in regard to the present status of sewage disposal in the United States and Canada, and to show reasons why the subject should receive more thoughtful consideration on the part of the general public.

Sewage Disposal Vital Matter.—In considering the economic side of the average utility, it is possible to make estimates, and later definite statements, showing the operating expenses, revenue obtained, etc., and thus show an economic value expressed in dollars and cents. In the case of sewage disposal, with a few exceptions, such as the sale of purified sewage for irrigation, sale of sludge for fertilizer, etc., which exceptions will be covered more in detail later in this paper, there is no revenue with which to offset operating and fixed charges, and it necessary to justify the expense of both first cost and operation in some other manner. That the question of sewage disposal is a very large and vital matter is plain when the following general data are considered.

In the first place 52 per cent of the entire population of the United States in 1920 was urban. In 1900 this figure was 39 per cent. There can be little question that the majority of urban over rural will continue to increase. As the cities grow, their sanitation problems become more complicated and expensive.

Our larger cities, generally speaking, have realized and are realizing the necessity of properly disposing of their sewage and industrial wastes. Millions of dollars have been, and will be spent, in a large number of our leading cities. Chicago, Milwaukee, Baltimore, Columbus and others are outstanding examples of cities that are meeting the question of sewage disposal in a broad and comprehensive way.

$100,000,000 Invested in Treatment Plants.—It is difficult to even estimate the total investment in disposal works in the United States, as the type of plant will differ in almost every city. It is not as simple a matter as, for instance, estimating the total value in dollars and cents, of the total number of water filter plants in this country. The costs vary some in different localities, of course, but a figure of the value per million gallons of installed capacity could be made, which would be accurate within reasonable limits.

In this case of sewage disposal, there are two distinct degrees of purification, namely primary and secondary, and there are several types of plants for accomplishing each. Partial or primary treatment can be accomplished better in one locality with one type of plant, and better elsewhere with another. This is also true with these cities where complete purification is required. Therefore it is impossible to estimate accurately the amount of money invested in this country for the disposal of sewage, wastes, etc.

An investigation of some 80 disposal plants for which accurate cost data were available, and correcting for difference between pre-war and present costs, and which plants are serving cities ranging in size from 1,500 to 50,000 population, gave average per capita costs of $4.37 for primary treatment, and $10.43 for complete treatment. These figures should be given very little weight, as the costs of the primary treatment plants varied from $1.46 to $8.70 per capita, and those for complete treatment from $4.44 to $19.50 per capita. Metcalf and Eddy in 1915 estimated that 41,800,000 persons were served by sewerage systems and that the sewage of about 84 per cent of this population was disposed of by dilution. This would give a population of 6,700,000 persons, whose sewage was being treated in disposal plants. Since 1915, hundreds of small cities, and a number of large ones have installed disposal plants. It is probable that at least 65,000,000 persons reside in cities served by sewer systems at this time, and that the sewage from at least 20 per cent of that number is treated at disposal works. Therefore it is safe to assume that sewage from at least 12,000,000 persons is receiving some sort of treatment. It is probable that this figure is too low. There are no authentic data as to the relative number of plants using partial treatment, and those using complete treatment.

It seems entirely reasonable to assume that there is at this time a total investment in this country for sewage disposal works, of at least $100,000,000, and probably quite a little more. At any rate this vast sum of money already invested, and the large sums already contemplated for plants throughout the country should, it seems, be ample proof that sewage disposal should at least have an economic side.

Economic Reasons for Disposal Plants.—As stated above the fact that sewage disposal plants are in the large majority of cases non-revenue producing, makes the building of such plants difficult, as the average taxpayer fails to see the need of the benefits to be derived from such a plant. Even though there is no visible return in most cases from the operation of disposal plants, it is quite evident that such vast sums of money that have been spent for such plants, would not have been spent if there were no economic reason for it.

Probably the most active influence in getting disposal plants installed, has been the work of the United States Department of Public Health, and the different state boards of health. Their efforts have have been entirely that of protecting public health. About 75 per cent of the present urban population of the United States is served with water supplies taken from surface supplies such as rivers, lakes and artificial reservoirs.

It is patent that to protect the health of those using these surface supplies, the supplies must be kept as pure and safe as possible. Water purification has and will continue to be the last trench, so to speak, in the protection of public health, so far as water supply is concerned, but in a large number of cases, it is impossible for the water purification plants to assume the entire load.

In the fall of 1917, the aggregate amount of water used by Kansas municipalities along the Verdigris River was approximately three times the flow of the river at the Oklahoma state line. Without the help from sewage disposal plants, it would have been impossible to furnish safe water supplies for those cities. Considerable has been said and written about the economic value of a human life, and the art of water purification has been given great credit for reduced death rates, and it is just that it should. The value of pure water has even been expressed in dollars and cents, based on its effect in the death rates from water borne diseases. Isn't it proper that sewage disposal should

receive its just share of this appraisement, for it is the "front line trench" in the process of keeping our surface water supplies safe for human use.

Broader Aspects of Sewage Disposal.—Sewage disposal should be considered in its broader aspect, which includes trade and industrial wastes, in addition to sanitary sewage. These wastes in a large number of cases are much more serious from the standpoint of stream pollution than domestic sewage, and as our cities grow and industries discharging undesirable wastes into the streams and water courses of the country, increase in number the situation will become more and more difficult.

There are a number of cases where streams have been made utterly useless for human use by the discharge of industrial wastes into them. There are several localities where the discharge of oil well wastes with their accompanying large amount of salt water have actually ruined a large number of public water supplies. In these cases sewage disposal in its broader sense undoubtedly presents an economic problem. In a good many cases it would be cheaper for the different oil companies, causing the pollution of a stream used for public water supply, to develop new supplies for the cities affected, rather than go to the expense necessary to abate the trouble. No one would think of curtailing the development of any oil field or burdening any industry in order to avoid stream pollution, and in some cases it may be desirable to simply dedicate certain streams as outlets for their wastes.

In the past a large part of the burden of disposing of industrial wastes has fallen upon the municipality. This may or may not be economically fair. If the industry or industries contribute, through taxes, a share of the expense that is in proportion to the amount of waste contributed, such a plan is equitable, but if not, it is an injustice. Often the mingling of trade wastes with the domestic sewage makes the purification of the combined sewage more difficult and expensive. Creamery wastes constitute a good example, where the quantity is any appreciable amount of the total. There is a marked tendency on the part of most modern industries to co-operate with municipalities, in connection with disposal of their wastes, and many have taken care of their own problems of disposal either in whole or in part, before discharging them into either public sewers or streams. Surely the proper solution of any such problem is an economic study, and one that can be expressed in dollars and cents.

What might be termed the most potent influence in causing cities and industries to care for their sewage and wastes, is the actual experience or possibility of damage suits. Our court records contain many cases where riparian owners have collected damages on account of the discharge of untreated sewage or wastes into streams or water courses. In some cases it may be possible to buy riparian rights, and avoid the installation of disposal plants, but usually there would be no limit, practically to the distance down stream that it would be necessary to acquire rights, or satisfy owners in some way. In cases where cities or industries are threatened with law suits, it is often easy to justify the cost of disposal plants on account of the probability of their total cost being less than would have to be paid out in damages.

Revenue from Sewage Treatment Plants.—In addition to the economic side of sewage disposal taken by and large, so to speak, there is also an economic side to the art itself. While there are no records indicating that any disposal plant is self-supporting, in the same way as a number of our other utilities, there are a number of examples where some revenue is obtained. Probably one of the best examples is at Milwaukee. The disposal of sludge from any plant has been, and continues to be, the most difficult feature of sewage disposal, and the larger the plant the more difficult the problem.

The American farmer has not been enthusiastic about sewage sludge as a fertilizer. This is, no doubt, due to the fact that few plants have been able to prepare the sludge in such condition that the farmer cares to handle it, much less to pay for it. Also the average sewage sludge without conditioning with other ingredients, particularly phosphoric acid and potash, will not give results comparable with a number of commercial fertilizers. By far the largest majority of plants are glad to give the sludge away to anyone willing to haul it.

In Germany, particularly, the farmers have become accustomed to the use of sludge in spite of the fact it has a low fertilizing value, and is delivered to them with a high moisture content. The time may come when our people will be willing to utilize the value of the many tons of sludge produced each day in this country. Several cities in the United States have tried to handle the sludge on a commercial basis, but have had very little success, and most of them are now glad to give it away. Milwaukee has recently installed a very modern sawage disposal plant, one of the most interesting features being the arrangement for handling the sludge. The part of the plant devoted to sludge disposal is an industry in itself. The sludge is treated in filter presses and driers, and is conditioned with other ingredients to make it desirable as a fertilizer. If the sale of this prepared sludge will only equal the cost of preparing it, the effort is justified, as the most difficult part of the disposal problem will be taken care of without a loss. The amount of sludge from the large number of smaller disposal plants would not justify the cost of preparation as a fertilizer, and usually can be handled by lagooning or drying on porous drying beds.

There are several plants where effluent is used for irrigation, with a resultant return from crops, or fruit, or from the sale of the effluent as irrigation water. At Pomona, Cal., there is a disposal plant serving the three cities, with a combined population of about 20,000, the effluent from which is sold under contract for irrigation water at a price that will pay the yearly operating costs.

The collection of sludge digestion gas is receiving considerable attention on the part of those interested in the art of sewage disposal.

Utilization of Gas.—The gas obtainable can be used for any commercial purpose. The amount of gas obtained depends upon the handling of the sludge digestion, the quantities apparently ranging from 0.3 to 0.5 per foot per capita day. At Decatur, Ill., gas collected from Imhoff tanks is used for heating and laboratory work at the plant, and it was at one time considered as fuel for internal combustion engines for driving compressors for use in activated sludge tanks. It is understood that the amount of gas produced per day averages about 100,000 cu. ft. Sludge digestion gas has a heat value comparable to that of artificial gas and in some cases as high as some of the natural gas supplies. It appears that the collection and use of gas from sludge digestion will play an important part in future design of sewage disposal plants. It is being used in several places as fuel in heating systems used to keep a high maintained temperature in the digestion tanks or compartments, with the possibility of reducing the space required for digestion.

There is evidence that the public is gradually developing a clearer understanding of the necessity for sewage disposal. A number of states have enacted drastic laws governing the pollution of streams. This last year Michigan passed a law, enabling cities to assess charges for sewer services, thus creating an operating revenue. These and many other signs of an awakening public conscience so far as the prevention of stream pollution, and avoiding of nuisance due to the discharge of untreated sewage into our water courses.

There is a somewhat dark side to the subject of sewage disposal, which is definitely an economic one. There are first of all a large number of plants throughout the country that are not designed properly, and cannot give best results, but what is worse is the great number of plants that receive little or no attention. Undoubtedly the investment represented by the plants that are receiving improper, if any, care would reach an enormous sum, and frankly represent wasted investments.

Salvaging Old Surfaces With Bituminous Macadam

Expenses in Texas in Constructing New Wearing Course

By T. E. HUFFMAN
County Engineer, Laredo, Tex.

IN these days of increasing destructive wear on the earlier types of gravel and water bound macadam wearing surfaces in Texas, the highway engineer and public official is every day confronted with the question: What is to become of the old gravel or macadam surface? There was a time when it was considered advisable to tear up and entirely discard them, but today this practice, in the light of the experience of a number of projects in the state, is looked upon as a regrettable waste of public funds. Many hundreds of miles of these lighter types of wearing surfaces were built in the state, during the earlier development of the present highway system, according to designs and under conditions that answered very well for the kind and volume of traffic then in existence, but which are now entirely inadequate for the present day traffic. What follows is intended to set forth, in a brief way, methods that have been followed in salvaging these old surfaces.

We have found that one of the most satisfactory methods for utilizing all of the salvage value of these old surfaces to be the incorporating of them into a base and constructing thereon a bituminous macadam wearing surface. The above type of wearing surface possesses many virtues which recommend its use for this purpose; it is a comparatively low cost wearing surface, where crushed stone is available within a reasonable distance; it adapts itself to any slight movement that may take place in what may be termed an unstable base, such as one composed of gravel or crushed stone; it is not difficult to construct, requiring no large amount of complicated plant equipment; it also provides a non-skid surface for traffic during both wet and dry weather.

Conditions for Resurfacing Old Gravel or Macadam.—An old gravel or macadam pavement, to make a satisfactory foundation for bituminous macadam wearing surface, should fulfill the following conditions:

(1) It should be well drained.

(2) It should be thoroughly compacted.

(3) It should have an adequate thickness and width.

Thickness.—In determining the thickness, impact must not be forgotten. During our school days we learned in physics that the inertia of a sufficient mass would overcome and prevent the transmission of an impulse. The importance of this principle as applied to the relationship between impact and thickness, or mass, in highway paving design can be pictured clearly in our minds by recalling the old mesmeric trick that used to be employed in the theaters whereby the victim was supported by two chairs, his head resting on one and his feet on the other. A heavy stone was placed upon his chest and the stone was then broken with a full swing of a large sledge hammer. It is quite evident what should have happened to the man if the heavy stone had not been over his chest; the mass absorbed the impact and saved the man. This is a rather unscientific way of expressing the importance of securing proper thickness in base design, but it at least serves to exemplify its needs in a clear and impressive manner.

When subsoil and drainage conditions are satisfactory, a bituminous macadam surface may ordinarily be constructed on 8 to 10 in. of old macadam or gravel. A careful study of subsoil and drainage conditions should always be made and care taken that the base is not designed thinner than theory and good practice demands. Either the direct or one of the contributory causes for nearly all failures of penetration roads usually can be traced to weak bases.

Widening Old Pavements.—In most cases the old surfaces are too narrow and the reconstructed pavements will have to be widened to safely care for the increasing traffic of the day. This can be done by adding new metal to each side of the old surface by the use of the trenched-in method. A number of examples are to be found in the East where, in salvaging old surfaces, the widening has been done by constructing concrete lanes on either side of the salvaged surface. In general, this type of widening has been considered good practice, especially as the appearance of the surface of the concrete lanes contrasts with the black center portion of asphalt and secures the desired separation of the traffic lanes. In all cases of widening of this character in the East it has been found that the concrete lanes should be approximately 42 in. in width, in no case less than 36 in. It has been the observation there that the 42-in. strip is sufficient in width for fast as well as for slow vehicles to keep their right hand wheels centered on the concrete strip and avoid concentrating the traffic in one place, causing the pavement to rut. The high cost of this method of widening, of course, would prohibit its use in this state except where the traffic demands were very great.

Costs.—Bituminous macadam costs from $8,000 to $14,000 per mile, and will generally carry from 1,500 to 2,500 vehicles per day. The annual cost of maintenance is reported to run from $200 to $300 per mile.

Salvaging the Old Gravel Surface on State Highway No. 2 in Webb County.—Thirty-three miles of State Highway No. 2, Laredo-San Antonio road, in Webb County—originally a 15-ft. width gravel-surfaced road—was salvaged in 1924 by increasing the thickness and width of the gravel and constructing thereon a bituminous macadam wearing surface with a compacted thickness of 2.5 in. and a width of 16 ft. The old gravel surface was widened to 18 ft. by trenching in an 18-in. width of new gravel on each side of the old surface. To this gravel surface was then added sufficient new material to increase the compacted thickness to a minimum of 8 in. The actual completed thickness of the constructed base varied from 8 to 12 in. On this base was spread a course of 2.5-in. to 1.25-in. trap rock at the rate of 1 cu. yd. in volume to 11.7 sq. yd. of surface. After shaping and rolling this course an application of hot asphalt, at the rate of 1.55 gal. per square yard, was sprayed over the surface; followed by spreading the intermediate course of crushed stone, which in this case consisted of limestone graded from 1.25 in. to 0.75 in., and was spread at the rate of 1 cu. yd. in volume to 55 sq. yd. of surface. After the intermediate rock was uniformly spread, broomed into the voids and rolled, an application of 0.5 gal. of hot asphalt per square yard was sprayed over this surface. The chatts of 0.75-in. to 0.25-in. sized limestone was then cast over this surface, broomed into the voids and the whole surface thoroughly rolled and the road opened to traffic. Continued rolling at this point will improve the pavement. Even after the road has been under traffic for some time an occasional rolling will improve the riding surface. The asphalt specified for this work was an 85 to 100 penetration oil asphalt. The average cost of the bituminous macadam surface was $7,321.86 per mile for

a 16-ft. width, or 78 ct. per square yard. This road has now been under traffic almost four years and the cost of maintenance has been practically nothing. There has been some settling of fills, particularly around bridge approaches, causing depressions in the surface. These depressions were built up with new materials, during the past winter, and this constitutes about the only maintenance expenditures on the surface course of this road since it was constructed. The cost of maintenance has amounted to only a few hundred dollars on the whole 33 miles of surface. The road is in good condition at present, although it is believed that it would be in the interest of good economy to give the surface a light seal coat to consist of about 0.30 gal. of a high penetration asphalt and about 1 cu. yd. of cover material to 100 sq. yd. of pavement surface. The surface should then need very little attention for several years.

Forms for Bituminous Macadam.—It has been our experience that the use of temporary form boards, or any type of side forms requiring removal after completion of the pavement, are impractical and should not be used in the construction of a bituminous macadam surface course. It is very difficult to compact the outside edges of the pavement properly where heavy plank forms are used, and impossible to remove the forms later without injury to the edges of the pavement. Only permanent forms, which will remain in place and become a part of the finished construction, should be used for this type of wearing surface.

On all of our work by far the best results have been obtained by constructing the shoulders before starting the bituminous macadam work, and then using the shoulders as forms for the bituminous macadam construction. The inside edges of the shoulders should be well lined and, where gravel is being used, left a little higher than the grade of the pavement edges. The bituminous macadam work is now carried on between the two shoulder courses, and the last application of the bituminous material is applied with one spray nozzle lapping over on the gravel shoulder; then, after adding the cover material, the pavement and shoulders are rolled as one surface. By this method the bituminous macadam gradually merges into the gravel shoulders without the tendency to leave a plane of weakness between the two surfaces.

If proper care is taken to bring the base course to the required grade and cross-section, no more difficulty is encountered in securing a good finished surface by this method than with the use of temporary forms. In fact, the finished surface presents a better appearance where the methods of construction above are used.

Spreading and Rolling the Coarse Aggregate.—Text books and standard specifications frequently call attention to the necessity of rolling the coarse aggregate until a thorough "mechanical bond" is secured. This is a splendid theory, but I have never been able to carry it out in practice. It may be that there is a crushed stone product in some parts of the United States, passing a 2.50-in. screen and retained on a 1.25 or 1.50-in. screen, that can be mechanically bonded by dry rolling, but I have never been able to find any Texas crushed stone with this characteristic.

Our best results have been secured by carefully spreading the coarse aggregate and then rolling it just enough, preferably with a light roller of from 3 to 5 tons capacity, to compact the course and give it a good cross-section. In this way very little of the stone is crushed under the roller and the course is left open, giving an opportunity to secure a good, even penetration of the bituminous material. It has been our experience that too much rolling, at this time, may do considerable damage; particularly where the pavement is being constructed on a gravel base. The use of hand rakes or coke forks is of considerable value in securing a good spread and an even surface for this course.

Just before beginning the application of the bituminous material to any section it should be given a final inspection to see that all parts of the course are open and that there are no spots showing a segregation of the finer material, dirt or other foreign matter. This course must be clean, uniformly open and of a porous structure to secure the best penetration of the bituminous material.

Application of Bituminous Material.—The bituminous material should be applied to the aggregate only when it is dry and the atmospheric temperature is above 50° F. Care should be exercised to see that the coarse aggregate is disturbed as little as possible during the application of the bituminous material. We encountered considerable difficulty in preventing the rear wheels of the distributor from forming ruts as it passed over the dry aggregate. Most of the rutting is caused by the tractive action of the rear driving wheels and if it becomes serious the trouble can be alleviated by having the distributor pulled over the dry coarse aggregate with the roller. If the ruts are only slight they can usually be removed with the intermediate aggregate, during the application of the second course.

On the Webb County work 85 to 100 penetration asphalt was used. We found this grade of asphalt should be brought to a temperature of around 325° F. to secure the best penetration of the material. It was found practically impossible to secure this high temperature by the use of ordinary heating methods, and a stationary super-heater was installed which gave excellent results and speeded up the work from 25 to 50 per cent.

The super-heater arrangement was very simple and worked perfectly. It consisted of installing a horizontal oil-field boiler along the unloading track and connecting it with the railroad tank car, after the tank car had been spotted opposite the boiler. Steam was then passed through the steam coils in the tank car until the asphalt was sufficiently liquefied to permit pumping. The material was then by-passed through the flues of the boiler and back again to the tank car until the proper distributing temperature was reached. After the asphalt in the tank car was raised to a sufficiently high temperature to permit pumping through the super-heater the temperature could then be "boosted" to 325° F. and from 50 to 60 minutes. The material could then be easily maintained at that temperature by keeping a slow fire in the fire box of the boiler. The super-heater was equipped with an accurate stationary thermometer so that the temperature could be easily regulated, and any danger of overheating or scorchng prevented. Two boilers are required for a plant of this nature; one to generate steam for the initial heating of the asphalt in the tank car and the other to use for the super-heater.

Some Observations on the Pavement After Being Over Three Years Under Traffic.—During the progress of the Webb County work several experimental sections of this type of pavement were constructed, using different combinations of materials. The standard section consisted of crushed trap rock for the coarse aggregate and crushed limestone for the intermediate and fine aggregate. The experimental sections were constructed with the following combinations:

(1) A section using limestone aggregate throughout.

(2) A section using trap rock aggregate throughout.

(3) A section to the surface of which was added a second seal coat; using about 0.20 gal. of bituminous material to the square yard and 1 cu. yd. of fine aggregate to 150 sq. yd. of surface.

(4) A section using the regular course of crushed trap rock and the first application of bituminous material, but, instead of using the intermediate course of crushed rock followed by the seal coat of bituminous material and chats, the base course was bonded and sealed with natural limestone rock asphalt.

(5) A standard section, except that the regular seal coat was omitted and the surface was sealed with natural limestone rock asphalt.

All of the above sections, so far, are standing up under traffic very well. It will take considerable more time to determine definitely any particular merit any one combination may have over the others. Experimental section

No. 3, in which a double seal coat was used, has pretty well demonstrated that a double seal coat is worth while. The extra seal coat adds very little additional cost to the pavement, but it gives the surface a better appearance, adds considerable to its wearing value and increases the imperviousness of the pavement against the leakage of storm water into the base course.

Experimental sections 4 and 5, where the natural limestone rock asphalt was used for the top course, has been watched with considerable interest. These two sections are showing up very well. They have a good appearing surface and show practically no wearing effects from traffic. These two sections are only about 150 ft. long, but it is believed that a combination of this kind might be developed into a good type of pavement, and it would be interesting to see a project of this type of pavement constructed. So far, there does not appear to be any difference in the wearing value of sections 4 and 5 and very little difference in their appearance. It would therefore seem that a choice between these two types would depend upon their respective costs.

During the construction of the pavement, traffic was permitted on the road after the intermediate aggregate was spread and rolled and before the seal coat was applied. Some times the section was under traffic four or five weeks before the seal coat was placed, the only exception being about a 3 mile section of the road where the traffic was detoured until the entire pavement was completed. This section when completed, presented the smoothest and best appearing surface of any other part of the road, but contrary to expectations, it is now probably the roughest section of any other part of the road.

General Observations.—Too much intermediate aggregate should not be applied after the first application of bituminous material; just enough to get the roller over it without picking up any of the material. Roll until the course is thoroughly compacted, feeding in the material as needed but avoid choking.

Care should be taken in keeping the cover stone uniformly applied. This can be accomplished by the proper use of brooms; both hand brooms and rotary sweepers. If an excess of screenings is allowed to segregate at different places on the surface, the excess material will later be whipped away, in spots, by traffic, causing "pot holes" to form in the pavement.

It is a perculiarity of a bituminous macadam pavement that an excess of any of the materials entering into its construction must be avoided. An excess generally causes more trouble than not enough. The reverse is true when it comes to rolling and observing the small details of construction. After the application of the intermediate aggregate it is not believed that too much rolling can be done.

Personally, I much prefer letting the contract for bituminous macadam on the volume instead of the square yard basis. If the contract is let on the cubic yard basis for the aggregate and the gallon basis for the bituminous material it gives the engineer more latitude—without injury to either of the contracting parties—in varying the quantities of materials to meet any changing conditions that may occur on the work from day to day. In this type of pavement, where the component materials are mixed in place, one finds it frequently desirable to make slight changes in the unit quantities of materials used in order to secure the best results.

Where the contract for applying the asphalt is let on the gallonage basis we prefer to base the payment for this item on the heated volume of the material measured just before beginning the application. This permits the measurement to be made at the point of delivery on the road and encourages the contractor to maintain the material at the proper temperature. The volume increase of the material between the normal and application temperature is about 10 percent.

When Salvage Value of the Road May Be of Minor Consideration.—In cases where the old road is poorly located or the horizontal and vertical curves are sharp and dangerous to traffic, the road should be relocated or the curves redesigned without consideration of the salvage value of the old road bed. Roads constructed 10 to 15 years ago were frequently located without proper vision of their future use. It is difficult to estimate the cost to the traveling public of a year's time in rounding a "square turn" on a road over the cost of making the same turn on a reasonable radius. Many of the earlier roads were poorly located not so much from the lack of engineering conception as from a lack of stamina or common ordinary "backbone" either on the part of the engineer or that of the governing body by whom the engineer was employed. Right-of-way difficulties form one of the most unpleasant features connected with highway work. But since the location is about the only real permanent engineering feature of a highway, effecting an accelerated saving in maintenance costs, and in time, money and safety to the traveling public, and at the same time it is one of the features most easily and quickly observed and apreciated by the traveling public, it is therefore believed that salvaging the surface of an old road should be a secondary consideration when the alignment and safety of a highway can be improved by a relocation of the road. It is bad enough to have made the original construction on a bad location, but certainly worse engineering judgement to perpetuate the poor location by constructing a higher type pavement upon it.

Acknowledgment.—The foregoing is a paper presented at the fourth (1928) annual short course in highway engineering at College Station, Texas.

Graham Brothers New 6-Cylinder Truck

Among the features of a new 1¾-ton 6-cylinder truck, recently announced by Graham Brothers, which appeal to contractors are the increased power and flexibility and the greater operating ease and safety provided by the new six cylinder power plant, eleven inch single plate clutch, four speed heavy duty truck transmission and Lockheed hydraulic internal expanding brakes operating in 16 inch drums in all four wheels.

The new 6-cylinder engine has a bore and stroke of 3⅜ x 3⅞ inches and displacement of 207.99 cu. in. The crankshaft is machined all over and is supported on seven main bearings having a combined projected area of 24.15 sq. in.

A temperature indicator is provided in the instrument panel and a thermostat automatically controls the temperature of the cooling water in the cylinder jackets radiator shutter makes it possible for the driver to warm the engine up more quickly and to keep the engine warm when the truck is left standing. Both are said to contribute to the high mileage obtained from the fuel.

The new 1¾-ton chassis is available in two wheelbases, 150 in. for bodies with 10-foot loading space and 165 in. for bodies with 12-foot loading space. The cab has been re-designed to afford greater comfort and better vision. The seat backs are of sedan construction and both back and seat cushions are deeper and more comfortable. The corner posts are of steel to provide slenderness and strength and the windshield is of one piece construction and equipped with an automatic wiper. The cab throughout furnishes ample evidence that the designers realize full well the importance of driver comfort.

One and three-fourths-ton model is only of the complete line of six cylinder trucks recently announced by Graham Brothers, the truck manufacturing division of Dodge Brothers, Inc. The capacities range from ½ ton to 2½ tons and bodies are offered to supply almost every conceivable hauling need. All capacities are fitted with four wheel brakes and all but the two smaller models, the Merchants Express and the Commercial Truck, have four speed transmissions. All have hand brakes operating on drums on the propeller shaft. The hand brake drums on the 1¾ and the 2½ ton models employ 8 inch drums with bands 3 in. wide.

Taxation and Public Improvements

Committee Report Presented to American Association of Engineers

By V. BERNARD SIEMS

Chairman, Committee on Public Improvements and the Tax Rate

THE object of this committee is to devise a model plan by means of which adherence to economic and comprehensive programs of local public improvements may be obtained for local tax-paying publics. Correlative to this general object is the necessity of also devising a model financial plan capable of supporting the improvements plan and of formulating recommendations for a type of administrative policy by which the rights of tax-paying publics will receive just recognition, expenditure of public funds guaranteed for the public good, and control of economic programs assured for their ultimate fulfillment without major deviation or without suffering other detrimental, such as political or social influences.

The preoccupation of business men and engineers with their own affairs, their consequent unwillingness to enter public office, or rather to accept the unpleasantness of political campaigns, and the apparent want of an activating interest on the part of other civic leaders and bodies keeps the ability and standards of municipal officers at a low level and holds open the high standard barriers to political prospectors and the public's exploiters.

Lack of Stability of Conditions.—This very lack of stability of conditions surounding public officialdom destroys any unity of purpose or adherence to a fixed purpose. Public officials who are in office to practice politics see no further than the end of their term of office in providing public improvements and handling the public money.

Thus the conditions surrounding public officials make difficult the adherence to any one program of improvements beyond one term of office and hence the expenditure of public funds economically for the public good.

Any program of public improvements that is to be really beneficial must extend through a period of time longer than the few years of term of the public officials administrations. In many cases local boards or commissions have been appointed and given jurisdiction over the expenditure of improvement funds. Such is a step in the rigth direction since those bodies function for the entire period of the public improvement program and can thus in a general way follow through a single comprehensive schedule of work. Those bodies do, to a great measure, safeguard public funds also and being interested third parties, by virtue of their position, accomplish a more or less economic utilization of the public funds and resources. But that plan is by no means perfect. In most such cases those bodies are appointed by the political party in power, and hence are influenced by and submit to the administration's policy. Examples can be found of such policies not reacting to the general public good.

Such conditions while not ideal can only be accepted as a product of liberal democracy of government. Consequently as these conditions cannot be changed, the duty of devising ways and means to accomplish the public good under such conditions devolves upon those persons or bodies sincerely interested in the public welfare.

Technical Advice Needed.—But again those public spirited individuals or civic bodies though activated by proper motives and earnest in their desire to benefit their communities are without sound locally dis-interested technical advice when undertaking or contemplating a program of engineering improvements. Our association through the work of this committee undertakes to discover a concrete means by which this lacking technical advice may become available and in a form that may be readily adapted to varying local conditions of finance and government.

This work is by no means easy to accomplish. We anticipate the necessity of preceding this, which may be looked upon at first as undesirable outside meddling, or certainly may be so called by a local political press, with an extensive educational program. Our effort might well be in accompaniment with the work now being forwarded by the National Municipal League, whose progress in municipal advancements has been far-reaching though not, to our belief, sufficiently broad.

Our position must also at the start be that of the minority representive. While democratic elections of public administrators reflect the will of the majority, they do not always represent best judgment for the public good. The popular office holder may not be the logical administrator to guide his community through a program of improvements. Political disinterest and public interest is required for the economic utilization of improvement funds and to place those improvements upon a long term schedule, secure adherence to such schedules, devise bases of taxation and plan financing that will be unaffected by political pressure, or change in political administrations.

But no finished plan can result immediately. We must first produce a skeleton work, sufficiently flexible in application to be amendable to local conditions, as our foundation for the more complete plan to follow.

This plan may then be fostered by our Association, published and advertised among civic bodies or the public at large as available technical advise at the call of public officials.

Our first avenue of investigation became taxation. Experience at once pointed out that taxation to provide public improvements has too many times lead to political manipulation of revenue with tax rate.

Public improvements are universally in demand. Reasonable investment of the public's money in them must be measured by the usual standard of value over the cost and a proper amount of return realized by taxation gauged to retire the public indebtedness on time. Advantage should be taken, therefore, of the increased value of a community through expansion and growth in population in order to justify the capitalization of such increased value in additional public improvements.

In this consideration of valuation of communities, the smaller political unit has usually been seen only as a part of the larger county or state unit and the taxing progress for revenue prorated according to divers rules. It is daily becoming more evident, however, that the individual communities should enjoy and be allowed to govern itself. Home rules offers one avenue leading towards the solution of taxation for capitalization.

Property Assessment Methods Must Be Revised.—And, considering the local taxation problem, we are led to believe that property assessment methods must be revised, made logical, equal in application, and positive. The tax schedule possessing these qualities, presupposes, first, accurate knowledge of the cost of government and improvements and the amount of revenue required.

In out treatment, however, it has been thought advisable to dispose of taxation first since in any program the expenditure must logically be budgeted to come within the logical and possible amount of money available to spend.

It is unnecessary for one to search the experiences of many cities to discover that most assessors do not know

how or why to assess. Consequently assessments are inconsistent, inequal, illogical and finally uncertain. Reform in assessment methods is necesary. Happily some progress has been made in this direction.

Assessors Should Be Technical Men.—Of a certainty, assessors should be technical men, but how many have such training. It is almost the rule that assessorships are jobs for the politically proficient, and may remain so in large measure.

If technically trained men are not to be assessors, then technical men should devise the valuation schedule to be applied in assessments. Logical, equal and certain valuation and assessments cannot be made by any hit or miss methods.

Land values and valuations of buildings and improvements by class must be equalized; a suitable record flat system inaugurated; the universal unit of value determined and applied to such records, and a guide systems, to values, from transfers, deeds, mortgages, rentals, salable price, put in operation.

Such scientific methods can only result to the public benefit by making sure and increasing the valuation of public holdings and by virtue of the same certainty as well as total worth ensuring higher credit.

More Attention Given to Scientific Assessing.—As stated, we have found that progress has been made along these lines. The National Municipal Review reports that the present trend of property taxation shows that more attenion is being given to modern and scientific assessing methods. One hundred per cent valuation basis is being approached by many and used by some municipalities, and also, more consideration is being given to the basis for taxation that was outlined in the Model System of State and Local Taxation, by the National Tax Association in 1919. But rather than be over-optimistic we must also admit that even where the 100 per cent valuation basis is operating, exemptions are growing and the Detroit Bureau of Governmental Research reporting the statistics of 176 cities investigated found no increase in tax rate for 1927 over that for 1926 though 53 cents over that for 1925. Yet this may mean that through proper assessment revenues have been increased with the same tax rate in force. If so, some cities will have already experienced the profit of scientific assessment over haphazard ones.

Under taxation we have here considered first, property taxation as being most interesting to the engineer and most in need of adjustment and possible of more ready local revision.

Both Personal Income and Business Taxation add to available revenue, but because of the more general aspect of these sources they do not materially affect local taxation for improvements.

The Struggle Between Executive and Legislative Rule.—Causes of failure in methods of administration have been discussed in the opening paragraphs of this report. Success in the work before us depends upon the ability to overcome the handicaps developing out of the struggle between executive and legislative rule, which schism divides responsibility, causes duplication of function with consequent inefficiency in administration and wasteful utilization of public revenue.

The Budget System was offered, and sometimes accepted, as a means of placing responsibility of the accounting of public expenditures, and likewise of planning for future improvements. But there is not yet universal recognition of or adherence to this means of checking efficient administration or of guarding against political extravagances. Credit should be freely given to the National Municipal League as a champion of this much needed reform, the outcome of which has been the acceptance, by a growing number of communities, of the City Manager or Commission Manager Plan. The acceptance of this plan of administration is always over strong opposition and often after established has been subject to further test at the polls, referendum, and sometimes defeated, by adherents to the principle of thorough-going and direct popular control, so called.

Budget System a Requisite.—A Budget System is generally recognized as a requisite to any reorganization in administration. It is a popular means of detailing necessary public works and their expense. Of course the value of the annual or term budget depends upon the degree of care exercised and its construction. Our work lies here in fool-proofing the budget procedure and its correlated premises.

Knowing the revenue available, the budget must comprehend a complete and thorough program of work and improvements. It should be well balanced, investment and expense against return and revenue. Major projects or activities should be itemized for although the operating head may be proficient, the public should know in advance how its money is to be spent. Procedure should be established to ensure proper expenditure of the funds for the purposes intended in the budget. This may be accomplished by providing a means of authorizing the incurrence of liabilities. Control over the rate of expenditure is also important, which may be accomplished by accounting statements at regular short intervals.

What the Improvement Should Cover.—A clear picture of the end in view in providing public improvements should be had before any attempt is made to secure adherence to a plan or to devise its financing. The improvements should cover all of the municipal or state activities in order to give a balanced program and usually would include utilities, streets, parks, buildings and zoning, public safety. None of these five major features of government should be slighted. Expenditures should be allotted intelligently to distribute the available fund relatively equally depending upon honest need of improvement in each. A clear picture of the ultimate end in view must be had in order that the program may be comprehensive and conservative of effort and expenditure. Thus each successive improvement should be in sequence and directed towards ultimate realization of the entire program, to ensure an economic and orderly progress.

Next, knowing the fund available through taxation, and having budgeted this in accordance with a thorough and comprehensive plan of improvements, the financial plan by which such an improvement program may be fulfilled must be devised.

Financing Permanent Improvements.—It is common to finance permanent improvements through the issuance of bonds, or special assessments usually liquidated in installments which necessitates issuance of bonds to provide money during construction. We do not consider here, any but permanent improvements as the public should not incur debt for any other except, perhaps, in dire emergencies of floods, etc. The terms of the bonds should be limited to the life of the improvements covered by them. This is not always adhered to and bonds are found unpaid on public improvements that have already outlived their usefulness or disappeared. Such a condition though would be corrected by following a proper plan for improvements. Sinking funds and reserves should be maintained to retire term bonds. However, serial bonds are usually preferable to term bonds in smaller communities. In large communities the market and stability of the issue would govern.

The bond term should not be too long; difference in annual costs do not justify assuming long interest burdens. Bond costs depend upon the amount of bond, rate of interest and time of maturity. Serial and term costs, therefore, are equal if the sinking funds earn the same interest carried by the bond. If the sinking funds earn higher, the term bond is cheaper unless the market should be unfavorable to that type at time of sale.

Bonds should provide capital expenditures. Recurring capital outlays such as extensions of utility services, etc., should be financed annually from current revenue.

Qualified Personnel Essential.—To carry out our plans of providing for and obtaining economic public improvements, a qualified personnel should be insured. Modern and thorough going civil service should be instituted, salaries standardized, by a schedule proportional to the value of the public holdings, thus to attract efficient technical workers and to properly protect them from political interference. The public, in proportion to its property value, should enjoy every technical serv-

ice it can afford. The personnel giving this service should be paid according to its responsibilities as determined by the value of the improvements and it should be free to devote its entire energy to the work in hand. Many valuable technical men are underpaid by municipalities because force of circumstances holds such men to their jobs. Municipalities would profit through class of service by paying professional rates of salary to professional men. Many cities suffer from the loss of service of capable public employees felled by the political axe. Recent examples are found in the action of Chicago, and Baltimore, in discharging technical men of national repute. No comprehensive plan can be carried out by or even entrusted to incapable civic employees. No matter how able the plan, those who are to work under it must likewise be able or it can only fail.

Finally, any plan designed for action must have a leader. By natural tendency of our publics, there are usually several well defined groups of opinion regarding any contemplated civic activity or local improvement. If this association is to formulate and present this plan of providing public improvements it might also provide a clearing house for these opposed views or the means of correlating its and the efforts of local civic bodies to this end. A local congress of such bodies might be suggested as the activating council charged with the furtherance of needed legislation for the purpose of properly developing local communities and for city and state planning.

This committee, therefore, after reviewing the problem and suggesting the avenue leading towards its solution recommends a further study by sub-committees of the six major features outlined above, taxation, Budget System, City Development and Planning, Finance, Civil Service and Public Relations and Legislation. It is better to spend time in study before producing our finished plan than to attempt to promote an ill-advised or incomplete one. Public officials as well as the public are daily learning through the experience of cities and towns. The excellent work and publications under the auspices of the National Municipal League merit thorough review before our final plan is selected. Thus we counsel thoroughness, no haste, wider publication of our present effort, that we may receive aid through the comments of as many members of our association as possible.

Committee Personnel.—The American Association of Engineers Committee consists of the following: E. F. Motsinger, Clarence W. Hubbell, A. R. MacLaren, Chas. S. Keating, James E. Sellers, Gordon E. Ferguson, R. E. Duff, W. Bernard Siems, A. A. Prendergast, Wynn Meredith, J. G. Huckins, Warren B. Keim, R. B. Taplin, and Daniel W. Patton.

$32,000,000 Spent for Municipal Recreation

An expenditure of $32,191,763 for municipal recreation in 1927 as contrasted with $19,200,000 in 1926 and $9,317,000 four years before, is revealed in the annual year book of recreation statistics for the United States and Canada, published by the Playground and Recreation Association of America.

Nearly half the 1927 outlay was for the purchase of land, buildings and permanent equipment, and the remainder was for upkeep and salaries.

Bond issues for recreation in the 5-year period 1923-27 totalled $47,106,648, including $11,960,200 last year. The number of cities reporting recreational facilities under leadership rose from 505 in 1922 to 815 in 1927. Of the latter number, 321 have year round supervision of recreation.

Baseball on public diamonds is falling behind the pace of growth of some other sports. From 1924 to 1927, the number of baseball players doubled, but that of playground ball players nearly tripled and basketball more than tripled. The number of teams in the six most popular municipal sports last year were as follows: Playground ball, 16,129; baseball, 14,676; basketball, 13,052; volley ball, 6,179; horseshoes, 4,901; and soccer, 3,493.

Of more than twenty-five million spectators at municipal sports, fifteen million attended baseball games.

Tennis courts increased by 723 and swimming pools by 147 over the 1926 totals. Enthusiasm for golf hit the municipal pocketbook to the extent of 69 new courses last year. At the same time that municipal golf courses are rapidly increasing, there is an universal need in the cities for children's playgrounds and baseball diamonds, which are not increasing rapidly enough to take care of the child population, according to the Playground and Recreation Association. The lack of baseball diamonds is responsible, in part at least, for the relatively slow growth of baseball as compared with some of the other sports, and the insufficient number of playgrounds helps to account for the increasing death toll of children at play in city streets, says the association.

Model aircraft construction and flying, a new activity on public playgrounds, was reported last year by 138 communities.

Boston, Mass., Increases Water Rates

The city of Boston, Mass., on July 1, advanced its water rates 20 per cent. The new rates are as follows:

	Old Rates (Per. M.)	New Rates (Per M.)
First 20,000 cu. ft.	$1.54	$ 1.84
Second 20,000 cu. ft.	1.43	1.71
Third 20,000 cu. ft. and up to 1,000,000 cu. ft.	1.32	1.58
All over 1,000,000 cu ft.	.88	1.05
Minimum rate	8.80	10.00

Cost of Sewer Construction at Providence, R. I.

The following table from the last annual report of S. Frank Nolan, City Engineer of Providence, R. I., shows the average depth of cut, nature of excavation, and contract cost of labor per foot, on the different sizes of regular sewers built during 1927 have been as follows:

Items.	Average Nature of Excavation	Average Depth of Cut, Ft.	Average Cost per Foot.
6-in. pipe in drains to curb line	Sand, dry	10.50	$ 1.59
6-in. pipe in drains to curb line	Sand, wet	10.50	1.92
6-in. pipe in drains to curb line	Sand and gravel, dry	10.50	1.43
6-in. pipe in drains to curb line	Sand and gravel, wet	10.50	1.62
6-in. pipe in drains to curb line	Hard pan, dry	10.50	1.57
6-in. pipe in drains to curb line	Hard pan, wet	10.50	1.87
6-in. pipe in drains to curb line	Rock	10.50	1.42
8-in. pipe in basin connections	Sand, dry	8.00	1.10
8-in. pipe in basin connections	Sand and gravel, dry	8.00	1.23
8-in. pipe in basin connections	Sand and gravel, wet	8.00	1.00
8-in. pipe in basin connections	Hard pan, dry	8.00	1.26
8-in. pipe in basin connections	Hard pan, wet	8.00	1.14
8-in. pipe in basin connections	Rock	8.00	1.30
8-in. pipe sewer	Sand and gravel, dry	11.67	2.00
12-in. pipe sewer	Sand, dry	12.00	2.47
12-in. pipe sewer	Sand, wet	12.00	4.22
12-in. pipe sewer	Sand and gravel, dry	12.00	2.53
12-in. pipe sewer	Sand and gravel, wet	12.00	3.57
12-in. pipe sewer	Hard pan	12.00	3.02
12-in. pipe sewer	Rock	12.00	3 23
15-in. pipe sewer	Sand and gravel, dry	12.25	2.95
15-in. pipe sewer	Hard pan, wet	12.25	3.22
15-in. pipe sewer	Rock	12.25	3.25
20-in. pipe sewer	Sand and gravel, dry	17.67	6.75
22-in. pipe sewer	Sand and gravel, dry	12.83	4.40
27-in. pipe sewer	Sand and gravel, dry	13.25	2.00
16-in iron pipe sewer	Sand and gravel, wet	12.25	5.00
22-in. circular brick and concrete sewer	Sand and gravel, dry	12.83	5.00
30-in circular brick and concrete sewer	Sand and gravel, dry	13 50	5.00
32-in. circular brick and concrete sewer	Sand and gravel, wet	13.67	5.00
38-in. circular brick and concrete sewer	Filling, dry	14.17	5.50
40-in. circular brick and concrete sewer	Sand, wet	10.00	6.00
42-in. circular brick and concrete sewer	Filling, dry	14.50	6.00
78-in. circular brick and concrete sewer	Sand and gravel, wet	14.50	12.25

Average cost of building manholes, each	$49.55
Average cost of building catch basins, each	50.25
Average cost of building extra inlets, each	11.97
Average contract price for rock excavation per cu. yd	3.41
Average contract price for brick masonry per cu. yd	13.50
Average contract price for concrete per cu. yd	6.60
Average contract price for lumber in foundation per M. ft	40.00

Recreational Opportunities Provided By City Park Systems

A Summary of the Park Systems of the United States

THE concentration of large populations in comparatively restricted areas, which has been a result of the industrial expansion of the past few decades, has brought with it the problem of providing adequate space and facilities for the recreation of children and adults. The following summary from the July Monthly Labor Review of a recent survey of the county and municipal park systems throughout the country, gives an idea of what has been accomplished by different communities in the provision of park and recreation centers.

Development of the Park Movement.—The park movement in the United States has developed since the middle of the last century, as prior to 1850 no laws had been enacted which provided for park and other recreation systems and not a single municipal department had been specifically created to handle parks and recreation. At the present time there is a multiplicity of agencies throughout the country which are dealing with the question. In the first 25 cities in size, for example, there are 62 different agencies dealing with public parks and public recreation.

The early idea of a park among park builders and planners was that of "a place where urban inhabitants could obtain the recreation coming from peaceful enjoyment of its rural, sylvan, and natural scenery and character." The type of recreation advocated at that time was of a passive or semi-active kind and the dominant ideal was that of peaceful enjoyment amid beautiful surroundings. This concept has changed and widened, however, and provision for a wide range of active forms of recreation have come to be included. The new movement toward the use of parks for active recreation began with the playground movement for children about 1880 and in the following two decades expanded into the general recreation movement for persons of all ages. In addition to changing the functional uses of many park properties, the new movement brought into existence a number of new types, such as areas devoted more or less exclusively to playgrounds, playfields, athletic parks, stadiums, neighborhood recreation parks, swimming and boating centers, golf courses, and boulevards and parkways. The growth in the scope of park activities added to the services of park adminstration agencies a series of complex and difficult social problems involved in organizing for the people a wide range of recreational activities of a physical, cultural, social, and civic nature which necessitate cooperative relationships with other public and private agencies.

At the end, therefore, of nearly three-quarters of a century of park development in the United States, the term "park" has come to mean "any area of land or water set aside for outdoor recreational purposes, whether it be recreation of a passive or an active nature or of any of the degrees between those two extremes, and that 'the recreation is expected to come in part at least from beauty of appearance.' "

Extent of Park Planning.—Growth of city planning in this country has been rapid in the past 20 years. During this time 176 cities, representing about one-fifth of the total population of the country, have had general plans made, including comprehensive park plans. Altogether about 390 cities have legally constituted planning boards which are organized to direct the development of the cities along the best lines. Regional park plans are also either actually in effect or are being worked out in many large cities, and there are 525 cities which have zoning ordinances. The matter of zoning is of fundamental importance in securing the permanency and stability of the properties set aside for parks and recreation centers.

Prior to 1900 there was only one organization dealing with the subject of parks which was national in scope. This association was made up of the executives in charge of the comparatively few park systems in existence at that time. About 1917 the society was reorganized into the American Institute of Park Executives and American Park Society. The Playground and Recreation Association of America was formed about 1905.

The provision of special courses in schools and colleges for the training of park executives and recreation leaders is comparatively recent, although at the present time there are more than 60 colleges and universities giving special courses for park executives, with special attention to landscape design and the propagation of trees, flowers, etc., while there are about 140 educational institutions providing courses for the training of playground leaders, and there is one national graduate school for the training of recreation executives.

Present Park Areas.—It was not until about 1890 that the real movement toward the provision of parks by municipalities began. Between 1852, when there was not a single municipal park in the country, and 1892, provision for municipal parks was made by only 100 cities; while 10 years later, 796 cities were known to have made a beginning toward providing parks. In 1925 and 1926, approximately 1,680 cities had provided nearly 250,000 acres of recreation spaces.

Although this would seem to indicate that rather remarkable progress in park planning had been made, in reality the situation is not so satisfactory as it appears.

New York City, with nearly 6,000,000 people, has only about 10,000 acres set aside for play, sports, and all other forms of outdoor recreation for children and young people and for adults. Practically the same thing is true also, of Chicago, which, with approximately 3,000,000 inhabitants, has less than 5,000 acres of public property set aside for the recreation of the residents. A great outlying section, however, has been developed which can be reached by trolley and antomobiles. This is the Cook County Forest Preserve which contains about 31,600 acres, the development of which represents one of the most notable civic achievements of any American city, exceeding, probably, anything done in any city of the world in recent times.

In the vicinity of New York City, other agencies than the city have provided areas which can easily be used by the residents. The most important of these is the great Westchester County Park System which was not started until 1922 but for which an expenditure of nearly $37,000,000 had been authorized by the end of 1926. The park now comprises more than 16,000 acres. Residents of New York City also have access to the Palisades Interstate Park in the States of New York and New Jersey which totals 37,190 acres and extends for several miles along the Hudson River. This park provides facilities for bathing, boating, camping, hiking, etc., and has been developed with the sole object of making it readily accessible for the people of the nearby cities.

Among the largest cities of the country, Philadelphia has the best showing as to ratio of park acreage to population, as with a population of less than 2,000,000 it has almost 8,000 acres of park properties, practically all of which are within the city limits. Although the city has no regional park plan under way there is one being outlined which will probably be developed

within the next few years. Some of the smaller cities, as might be expected, have a larger ratio of park acreage to population than the large cities. Minneapolis, with aproximately 14 per cent of the area of the city in park property and a ratio of 1 acre of parks to every 80 inhabitants, leads all cities of more than 100,000 population except Denver and Dallas, in both of which, however, a large part of the park acreages lies outside the city limits. Kansas City, Mo., has a ratio of 1 acre to every 100 inhabitants; Los Angeles and Portland, Ore., 1 to 118; Indianapolis, 1 to 122; and Washington, D. C., 1 to 128. In all these cities there is a lack of children's playgrounds and neighborhood playfield parks, which is due to the failure to plan for such spaces before the residential sections were built up.

A comparison of the cities of the country, grouped according to the United States census population figures, with the reports received of the park acreage in these cities shows that all these groups of cities are still far from being adequately provided with parks. In the group having populations from 100,000 to 250,000 there are only six that have a park acreage that gives them a ratio of 1 acre to every 100 persons or less and of the 73 cities having populations of from 50,000 to 100,000, only 16 equal this ratio, while many fall very far below it. Of 1,321 villages with a population of less than 2,500 reporting on their local park situation, 57 per cent stated that they had no parks, while a similar condition was found among communities with populations ranging from 2,500 to 5,000.

The ratio of park acreage to population which has been used as the simplest measure of the extent to which the cities are providing recreation areas does not furnish an accurate measurement, however, as the park system may be inadequate if most of the total acreage is in one large park, if the parks are so distributed that they are not readily accessible or if they do not provide a variety of recreation facilities.

The limited number of communities under 5,000 population reporting parks is indicative of the lack of play facilities in numerous small towns, villages, and rural districts. Millions of people living in these localities have no park or playground facilities. Space is not lacking, as there are always open fields and vacant lots, but these are entirely inadequate for recreation without proper equipment and competent leadership. Twenty per cent of the communities in the population group 5,000 to 10,000 reported no parks, although like the smaller towns such places as school yards and vacant lots may be used in part for recreation. The total park acreage of 50 typical cities of the population group 10,000 to 25,000 is several times as great as that of Baltimore, Boston, or St. Louis, each of which has a population equivalent to that of this group of smaller places. There are 324 park properties in these cities as compared with 66 in Baltimore, 99 in Boston, and 96 in St. Louis.

One hundred and thirty-three of the cities in the group of 25,000 to 50,000 population reported parks, but 20 of these cities had 45 per cent of the total park acreage. In these 20 there is an average of 1 acre of park to every 53 inhabitants. There is the same inequality in park development found among the cities ranging in population from 50,000 to 100,000.

In the large cities, those having 250,000 inhabitants or more there seems to be no special relation between park planning and city growth while in the nine cities which have from 500,000 to 1,000,000 inhabitants there is decidedly less park acreage in proportion to the population than in most of the smaller cities. These cities are especially lacking in children's playgrounds and neighborhood parks, yet every one of these communities has a planning commission and a more or less comprehensive scheme for the extension and development of the park system. The area in parks in the three largest cities—New York, Chicago, and Philadelphia—is smaller in proportion to the population than any one of the groups of cities from 25,000 inhabitants upward.

Detailed examples of some of the park recreation systems of the different cities, such as those of Minneapolis, Spokane, Houston, and Pasadena, show admirable types of park development from the standpoint of number of acres, types and distribution of properties, character of development, and quality of maintenance.

Municipal Parks Outside City Limits and County Park Systems.—The extension of the park systems beyond the limits of the city has been made possible by the widespread ownership of the automobile. Through this improvement in the means of transportation a city recreation system may be extended many miles into the country and still be used by large numbers of people. Park properties have been acquired outside the city limits by about 100 cities. The largest city park outside the city limits is owned by Phoenix, Ariz., and comprises 15,080 acres in one property while Denver owns more than 10,000 acres in mountain parks. The purchase of park areas outside the city limits is a wise procedure, moreover, because of the probability that such areas will be greatly needed as the city develops.

The first county park system to be established was that of Essex County, N. J., which was started in 1895. Although the plan was extremely successful the idea spread slowly and few such systems were started before 1920. Since that time, however, a number of county park systems have been started in different sections of the country and there are now 33 counties which have one or more county parks with a total area of 67,464.71 acres.

Under certain conditions, the report states, counties are "admirably adapted to park planning and they offer an undeveloped field of tremendous importance in the general outdoor recreation movement. Although many of the outstanding county park systems have been designed as units for handling metropolitan park problems, it is conceivable that the greatest field of usefulness of this type of system will be in providing recreation opportunities for the rural districts and the people in the thousands of small municipalities throughout the country."

Recreation Facilities in Parks.—The most significant trend in the municipal park movement in the last 25 years has been the use of parks for active recreation. While the use of parks for active games and sports was opposed at first by most park executives and commissioners, today at least 90 per cent of those in charge of parks favor their use for active recreation, as well as rest and reflection.

The place of children's playgrounds in a park system is indicated by the fact that 309 cities reported 4,819 playgrounds located in parks. The park recreation facilities reported most frequently were areas for baseball, football, soccer, playground ball, horseshoe pitching, basket ball, field hockey, track, field events, volley ball, hand ball, and croquet. Ninety-eight cities reported golf courses in parks. Among the other sports for which facilities are provided are bowling, roque, polo, archery, and shooting. Wading and swimming pools, bathing beaches, and boating facilities are common, and in the northern sections of the country the various winter sports are provided for.

The municipal parks are also the centers for a wide range of social, recreational, and educational features; many of them contain clubhouses, gymnasiums, and field houses and thus serve as community centers. Art galleries, museums, outdoor theatres, band stands, and conservatories located in the parks add to the cultural and educational life of the people, while purely recreational buildings and structures include boathouses, grandstands, bathhouses, and dancing pavilions. Zoological gardens were reported by 99 cities. Facilities for picnics reported by 117 cities are part of the movement to encourage outdoor activities on the part of families and community groups.

Park Finances.—Considerably over $1,000,000,000 is the estimated amount of capital invested in parks at the present time, while the operation and maintenance expense of these parks is in excess of $100,000,000 per year.

The financing of park systems falls into two distinct divisions, covering the

acquisition and permanent improvement of properties and the operation and maintenance of the parks. Various methods are followed in financing the purchase and permanent improvement of these properties. These include: Use of current funds of the park and recreation department or by direct appropriation of a municipal or county government; the sale of bonds secured by general taxation, by special assessments, or by a combination of these methods; installment payments out of the net proceeds obtained from the operation of the particular project itself; proceeds from gifts, bequests, etc.; and the acquisition of properties through use of the principle of excess condemnation or excess purchase. Acquisition and improvement may also be financed out of current revenues, although on the whole this has been found to be an undesirable method.

The revenues from the operation of recreation facilities include the lump sums which may be paid for concessions or the fees paid for the use of certain types of recreation facilities. These fees are charged usually on the theory that the patrons of a given facility should pay for the operation and maintenance where the general public had provided the capital outlay and also because the opportunities provided are valued more if paid for than when they are free.

Early Examples of Town Planning in the United States.—As early as 1565, when the Spaniards founded Santa Fe, a square or plaza was set aside in the center of the town for a public square which still serves the public as a center for the social, political, and recreational life of the city. This plan, which was followed by the Spanish builders of towns in the South and Southwest, influenced the plans of such cities as San Francisco and Sacramento. while the English colonists on the Atlantic coast followed the custom of setting aside spaces for town commons, the most notable example being the Boston Common. In other cities, notably Philadelphia and Savannah, the city plans provided for the reservation at regular intervals of spaces for the use of the public, while in Washington a combination plan of rectangular and radial streets provides numerous open spaces. These and other plans for setting aside spaces for community use were in general forgotten or discarded in the century which saw the rise and expansion of modern industry and commerce.

Obstacles to Town Planning.—One of the principal causes of the failure to follow a consistent policy in the development of American towns and cities has been the difficulty in democratically governed communities of securing unity of mind upon a given policy or plan. Another reason was the rapidity with which the population of the country changed from a rural to a predominantly urban population and the general failure to understand the significance of the change which was taking place or to plan wisely for the changing living conditions, while a further obstacle to the development of a proper park policy has been the prevalence of rural ideas and ideals under urban conditions and in urban communities. In spite of the fact that more than half of the population is located in the cities, rural individualism still controls to a large extent, because the "peculiar political condition whereby State governments exercise considerable control over laws affecting cities tends to perpetuate rural control even in cities located in States that are largely industrial."

New Power Take-off on Elevating Grader

A chain is only as strong as its weakest link, and an elevating grader is only as efficient as its carrier. The carrier determines the capacity of the machine. The new Austin Power Take-off—a device by means of which the carrier of the Austin "Contractor's Special" New Era Elevating Grader is driven directly from the engine of the "Caterpillar" sixty tractor—not being dependent for its power upon the traction of the rear wheel of the grader—will save time, labor and money, according to the manufacturers.

It provides a faster moving belt, affording greater capacity, as well as a constant, uniform belt speed, irrespective of the movement of the grader as a whole; no delay in delivering dirt.

The drive is positive irrespective of the load put upon the carrier by the plow, avoiding clogging and providing uniform delivery of dirt. Thus the plow may be worked to its full capacity, greatly increasing the capacity of the grader. Work may be started much sooner after a rain than when the carrier gets its power from the rear wheel.

A big saving in gasoline, and wear and tear on the tractor, by reason of the decreased load it has to pull, is made possible by this new method of carrier drive, illustrative by the difference between a six-ton load with one wheel braked until it is nearly locked tight, and the same load with all four wheels running free.

A big saving in repairs to the grader can be realized by reason of the elimination of wear on the drive wheel, short shaft, gears and other driving mechanism between the rear wheel and the carrier.

"The very nature of the work for which the Power Take-off was designed makes imperative not only ruggedness, but also the very highest quality of material and workmanship, and no expense has been spared in this connection in order to insure to the user a device that is said to be almost immune to breakage from loads or rough handling.

Adjusting Overrun and Underrun of Aggregate

An interesting account of a sinple test and the resulting adjustment of the amount of stone and gravel used in the mix on a concrete road job in Freestone County, Tex., was given by M. B. Hodges, Resident Engineer, Texas State Highway Department, in a paper presented at the 4th (1928) annual short course in highway engineering at College Station, Tex.

Two paving projects were started at very nearly the same time. One contractor was using, as coarse aggregate, a good quality of washed gravel, while the other was using a good quality of crushed stone. Fine aggregate in both cases was of approved quality and of very nearly the same screen analysis.

An average daily screen analysis of the stone was as follows: 100 per cent passing 2½ in.; 27 per cent retained on 1½ in.; 72 per cent retained on ¾ in.; and 96 per cent retained on ¼ in. This stone met the specifications for coarse aggregate.

An average daily screen analysis of the gravel was as follows: 100 per cent passing 2½ in.; 13 per cent retained on 1½ in.; 52 per cent retained on ¾ in., and 98 per cent retained on ¼ in. This analysis also met the specifications but the gravel contains more fine material than the stone. After work had been started on both projects, it was found that the contractor using the stone was having an overrun in the number of daily batches. This overrun was consistently about 3 per cent. The contractor using the gravel was having an underrun of about the same percentage. These percentages were determined quite accurately. Samples of both types of materials were brought into the office and a crude but effective test was made in the following manner: A quart measure was used and two batches of concrete were made, using the materials in the same proportions as on the job, namely 1:2:3½. Water was added to make a workable and consistent mix and the two batches were measured. The resulting numbers were divided by the total number of quarts originally used and multiplied by 42.25, the number of cubic feet of dry materials which were assumed to be necessary for a cubic yard of concrete. The batch using the gravel resulted in 28.4 cu. ft. while the batch using the stone resulted in 25.4 cu. ft. The mix on the paving job was then adjusted by adding to the stone mix 1 cu. ft. of sand and taking from the gravel mix 1 cu. ft. of sand. After this adjustment had been made, the mix checked out very nicely, so long as the screen analyses of the gravel showed the same average grading as that used in the above test. The gravel mix also checked out correctly.

Program of Forty-Seventh Annual Convention of the New England Water Works Association

Papers That Will Be Presented at Montreal Convention

THE 47th annual convention of the New England Water Works Association will be held in the Windsor Hotel, Montreal, P. Q. Canada, September 18, 19, 20 and 21.

The office of the secretary will be located in the Concourse, on the first floor, Windsor Hotel, and will be open for registration at 3 p. m. Monday, September 17.

Technical Meetings and Exhibits.—The exhibits will be located in the Rose Room and Concourse, first floor, Windsor Hotel; technical sessions in Windsor Hall. Superintendents' sessions on Wednesday will be held either in the Prince of Wales Salon or in the Oak and Blue Rooms. These rooms are adjacent to the Concourse, Rose Room and Windsor Hall.

Immigration Requirements.—The Immigration Regulations pertaining to residents or citizens of the United States who have visited Canada and are returning to the United States are not especially strict, but when returning to the United States all persons are required to prove to the satisfaction of the Immigration Inspector that he is legally entitled to enter.

Citizens who are native born should have a certified copy of their birth certificate. If this cannot be obtained a certificate from the Registrar of Voters of the city or town in which the person votes stating that the person is a voter will be sufficient.

Naturalized citizens should have their naturalization papers. If for any reason these are not available then a certificate from the Registrar of Voters as in the case of native born citizens will be sufficient. These requirements apply to female citizens as well as to male.

Transportation.—Arrangements have been made with the Canadian Pacific Railway to handle reservations in special service. Plans are being made for two special trains from Boston, Monday, September 17—one to leave about 9 a. m., standard time, arriving Montreal 6:30 p. m.—the other to leave 9:30 p. m., arriving Montreal 7:30 a. m. Special N. E. W. W. trains will depend on securing sufficient number to operate, otherwise special cars will be arranged.

Trains will run via Lowell, Manchester, Concord and St. Johnsbury. Connections from all points furnished on request to Canadian Pacific Railway.

Summer tourist round trip fares in effect from all points. The rate Boston to Montreal and return is $21.45. Pullman fares from Boston are as follows: —In each direction, parlor chair, $2.25; lower berth, $3.75; upper, $3; compartment, $10.50; drawing room, $13.75.

Members from New York City and points south may make arrangements for through service to Montreal, with special parlor or sleeping cars, by applying to Mr. E. C. Drake, District Passenger Agent, Grand Trunk Railway System, New York City.

Day trains leave New York, Grand Central Terminal, at 7:35 a. m., arriving Montreal at 9:35 p. m.

Night trains leave New York, Pennsylvania Station, at 8 p. m., arriving Montreal at 8:40 a. m.

Fares from New York to Montreal are as follows:

One way, $14.01; round trip, $22.42.

Parlor chair, in each direction, $3.00; lower berth, $3.75; upper berth, $3.00; compartment, $10.50; drawing room, $13.50.

Program.—The following gives the program as announced by Robert Spurr Weston, chairman of the program committee:

TUESDAY, SEPTEMBER 18
Morning Session, 10 a. m.

Address of Welcome by
His Worship Camillien Houde, Mayor, City of Montreal.

Secretary's Report.

Treasurer's Report.

Editor's Report.

Award of Dexter Brackett Memorial Medal.

Closing of Polls.

Appointment of Tellers.

REPORT OF COMMITTEES ON

Standardization of Cast Iron Pipe and Special Castings, Frank A. McInnes, Consulting Engineer, Chairman.

Simplification of Man-Hole Frames and Covers. Frank A. McInnes, Consulting Engineer, Chairman.

Specifications for Cast Iron Pipe and Special Castings, Frank A. McInnes, Consulting Engineer, Chairman.

Standardization of Pipe Flanges and Fittings, Frank A. McInnes, Consulting Engineer, Chairman.

Code for Pressure Piping, Sectional, Malcolm Pirnie, of Hazen & Whipple, Consulting Engineers, Chairman.

Yields of Catchment Areas, X. H. Goodnough, Chief Engineer, Massachusetts Dept. of Public Health, Chairman.

Painting Standpipes, A. O. Doane, Division Engineer, Metropolitan District Commission, Chairman.

Standardizing the Steps of the Meter Schedule, Arthur E. Blackmer, Superintendent Water Works, Plymouth, Mass., Chairman.

Legislative Matters, Charles W. Sherman of Metcalf & Eddy, Consulting Engineers, Chairman.

Grounding of Currents on House Plumbing to Act in Connection with a Similar Committee of the American Water Works Association, George A. Sampson of Weston & Sampson, Consulting Engineers, Chairman.

Representative at Tests of the Bureau of Standards, Harry W. Clark, Director and Chief Chemist, Massachusetts Dept. of Public Health.

11:30 a. m.

Visit to Plant of Consolidated Pipe Co., Limited, of Montreal. Luncheon provided by the Company.

Afternoon Session, 2 p. m.

Protection of Catchment Areas, John F. Skinner, Assistant City Engineer, in charge of Additional Water Supply, Rochester, N. Y.

Report of Committee on Cement-Lined Pipe, (Illustrated), Robert Spurr Weston, Chairman, of Weston and Sampson, Consulting Engineers, Boston, Mass.

Report of Committee on Cross Connections, Robert Spurr Weston, Chairman, of Weston and Sampson, Consulting Engineers, Boston, Mass.
E. Sherman Chase, Secretary, of Metcalf and Eddy, Consulting Engineers, Boston, Mass.

WEDNESDAY, SEPTEMBER 19
Morning Session, 9 a. m.

Unusual Methods of Water Purification, M. E. Flentje, Superintendent of Purification, Community Water Service Co., New York City.

Recent Developments in Water Purification, Wellington Donaldson, Fuller and McClintock, Consulting Engineers, New York City.

The New Water Purification Works at Greenwich, Conn., (Illustrated), E. Sherman Chase of Metcalf and Eddy, Consulting Engineers, Boston, Mass.

Afternoon Session, 2 p. m.

Effect of Sunlight on the Determination of Chlorine by the Ortho-tlodin Method, F. R. McCrumb and W. R. Kenny, of the Research Laboratory of The La Motte Chemical Products Company, Baltimore, Md.

The Equipment and Operation of Water Works Laboratories, Melvin C. Whipple, Asst. Professor of Sanitary Chemistry, Harvard University, Cambridge, Mass.

Zeolite Water Softening for Municipal Supplies (Illustrated), F. D. Kneeland, Chemist Ohio Valley Water Co., McKees Rocks, Penna.

The Extension of the Works of the Greenwich Water Company, Greenwich, Conn. (Illustrated), Dana M. Wood, with Stone and Webster, Engineers, Boston, Mass.

Evening Session, 8 p. m.

The McTavish Street Pumping Station, Charles J. DesBaillets, Chief Engineer, Montreal Water Board, Montreal, Canada.

The Montreal Filtration Works, Frederick E. Field, Division Engineer, Montreal Water Board, Montreal, Canada.

SUPERINTENDENTS' CONFERENCE
WEDNESDAY, SEPTEMBER 19

In Charge of Past President Stephen H. Taylor, Supt., New Bedford, Mass., Water Works.

Morning Session—9 a. m.

Subject—Distribution.

Opened by Paper on "Some Distribution Problems," Fred B. Nelson, Assistant Engineer, Dept. of Water Supply, Gas and Electricity, New York City.

Followed by general discussion.

Afternoon Session—2 p. m.

Opening Subject — "Electrolysis of Water Mains."

Evening Session 8 p. m.

Opening Subject—"The Effect of Flushometer Vales Upon Water Works Practice."

These conferences are informal and any questions which members would like discussed should be sent to Mr. Taylor before the meeting, that time may be reserved for them.

THURSDAY, SEPTEMBER 20TH
Morning Session, 9 A. M.

Factors in the Design of Distribution Systems, V. Bernard Siems, Vice President and Chief Engr., Detwiler and Company, Inc., New York City.

Visit to the Montreal Water Purification Plant. Luncheon provided by courtesy of the City of Montreal. Ladies are cordially invited.

Afternoon Session, 3 P. M.

The Gas Producer Plant for Water Pumping at Manchester, Mass., a Record of Twenty Years, Raymond C. Allen, Civil Engineer, Manchester, Mass.

The Oxy-Acetylene Process in Modern Industry. R. W. Boggs, The Linde Air Products Company, New York City.

Demonstration of the Televox System, the Westinghouse Co., Pittsburgh, Penna.

General Discussion:

Are the Present Specifications Dealing With Fire Hydrants and Valves With Special Reference to Valve Stems Satisfactory? Discussion to be opened by Mr. Frank A. McInnes.

FRIDAY, SEPTEMBER 21ST
Morning Session, 9 A. M.

A New Pipe for Water Mains (Illustrated), R. W. Mitchell, Consulting Engineer, The Asphalto-Concrete Corporation, New York City.

Report of Tellers of Election.

President's Address.

ENTERTAINMENT
TUESDAY, SEPTEMBER 18TH

Informal Reception and Dance at Windsor Hotel. (Courtesy Water Works Manufacturers' Association.)

WEDNESDAY, SEPTEMBER 19TH (Ladies)

10 a. m. Trip to Mount Royal. (Courtesy of the City of Montreal.)

2:30 p. m. Theatre Party. (Courtesy of the Water Works Manufacturers' Association.)

8 p. m. Ladies' Reception and Bridge, Windsor Hotel. (Courtesy Water Works Manufacturers' Association.)

THURSDAY, SEPTEMBER 20TH

11 a. m. Inspection of the Montreal Water Purification Plant. Luncheon provided (Courtesy of The City of Montreal.)

3 p. m. Shopping Tour for Ladies and Fashion Show. (Courtesy of the Montreal Tourist and Convention Bureau.)

7:30 p. m. Dinner Dance and Entertainment Windsor Hotel. (Courtesy Water Works Manufacturers' Association.)

FRIDAY, SEPTEMBER 21ST

Afternoon—

Especially Arranged River Excursion and Trip Through the Lachine Rapids. Details to be announced at the convention. (Courtesy Water Works Manufacturers' Association.)

Draftsmen Put in Single Bureau

An order placing all the drafting forces of the city under the supervision of William O. Atwood, head of the Bureau of Plans and Surveys, was issued yesterday by Charles F. Goob, Chief Engineer of Baltimore. In a letter to the bureau heads in the Department of Public Works, Mr. Goob said:

"In the preparation of your budget for 1929, where you have loans available, you are directed to set up a sufficient amount of money to reimburse the Bureau of Plans and Surveys for work that is to be done under loans that are appropriated.

"Further, where classified draftsmen are incorporated in your present budget please confer with Mr. Atwood, with the end in view of transferring this personnel to the Bureau of Plans and Surveys.

"It is understood that personnel who are classified engineers and who do designing work are not to be transferred to that bureau."

It was said at the City Hall that the order was in line with Mr. Goob's plan to coordinate all the forces of the Department of Public Works. The bureau budgets for 1929 will be prepared in this way.

It is expected that the salaries of all the bureau heads will be increased to $6,000, to place them on an equality in this respect with Mr. Atwood, Walter G. Hammond, Engineer of Buildings, and others whose pay was increased several months ago by the Board of Estimates, on Mr. Goob's recommendation.

When the Board of Estimates made up the budget for 1928, the salaries of these bureau heads were fixed at $5,000, at the suggestion of Mayor Broening, who had the board standardize that figure.

Park Board Would Supervise Airport

The City Park Commission will administer the East Boston Airport when it is leased by the City of Boston, Mass., if Mayor Nichols can obtain City Council concurrence in an order which he is to present. The commission is composed of W. P. Long, chairman; Charles H. Innes and F. S. Deland.

Lieut. Donald Duke of the Army staff, now operating the airport for the so-called Municipal Air Board, headed by Chairman Gardner Fiske, will continue as superintendent, under the Park Commission's administration of the airport, if Mr. Nichols can persuade the Army authorities at Washington to give Duke leave for this service.

The Mayor will seek an appropriation of about $125,000 of taxpayers' funds, with which to expand and improve the airport, and will soon ask for about $75,000 of this sum. This Fall he hopes to get underway the initial program of installing runways at the airport, of fencing it, and also the big task of properly lighting and grading the plant.

Springfield, Ohio, Approves Bond Issue

Tentative approval of a municipal bond issue amounting to $2,692,000 for improvements in the public schools, City hospital, park system and flood control of Springfield, Ohio, was given recently by a citizens' committee appointed some months ago to draft an improvement program for the city.

The bond issue will be submitted to voters in the November election.

Bucyrus-Erie Shovels Have New Mounting

One of the interesting new developments in excavating machinery for road building and general contracting noted in recent convention exhibits, was the "Single Shaft Drive" caterpillar type mounting for Shovels and Cranes introduced by the Bucyrus-Erie Company, of Erie, Pa.

Since caterpillar type mounting has come to be recognized generally as the most satisfactory for power shovels and cranes, the most important consideration now is to get the continuous-tread mounting in its simplest and most reliable form.

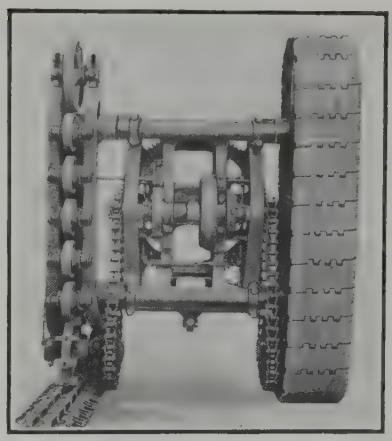
As the new Bucyrus-Erie mounting has fewer parts, extra strength can be built in with no added weight. Besides which, this new mounting combines several unique features that users are finding very valuable in service, according to the manufacturers.

The "Single Shaft Drive" mounting is in the highest degree non-clogging—even when it is shoveled full of dirt, it throws out the material as it moves ahead its own length, it is claimed. The drive chains, which are of hardened forged steel are self-cleaning.

It easily takes grades of 30 per cent, and steeper, say the manufacturers. A two-way brake, which operates with a ratchet effect, allows free movement in either direction as desired, but locks the machine against the digging, or on a grade.

Sharp turns can be made with this mounting as well as gradual turns. It can make either a right angle turn in one spot, or a long radius turn—steering from either end of the treads, with the machine moving either forward or backward, it is said.

Another feature of this mounting is its perfect accessibility for renewing or inspecting parts. Any wearing part of this mounting can be quickly and easily removed without disturbing any other part.



View of the New Mounting, Showing Its Simplicity

With only one drive shaft and gear below the deck, the extreme simplicity is very noticeable. The one gear and its pinion are enclosed, protected against dirt and grit—and operate high above the ground. There is 12-inch clearance underneath; nothing to drag when moving over rough uneven ground.

The truckframe is a one-piece annealed steel casting, 23 inches deep—practically indestructible. Drive shaft splined—no keys. Treads are exceptionally strong, and have 1½ in. hardened steel pins.

All Gas+Air and B-2 Steam Bucyrus-Erie machines are now being furnished with this new mounting as standard equipment. Its simplicity and strength, combined with its performance on many machines which have seen hard service, has shown it to be a meritorious mounting for shovel and crane work, say the manufacturers.

A Bucyrus-Erie Machine Equipped with the New Simple Mounting

Trade Publications

The following trade publications of interest to municipal engineers, waterworks engineers and contractors, sewage engineers and contractors and others in the municipal field, have been received. Copies may be secured upon application to the manufacturers named.

Meters.—National Meter Company, 299 Broadway, New York City, has recently published an interesting little booklet under the title "The High Cost of Low Prices." In this literature they discuss the significance of low prices as being a measure of low value or, in other words, the fixing of a cut price by a manufacturer is but his admission that the goods are not worth the higher price asked for competing merchandise. The purpose of this discussion of prices is to maintain the idea that the above concern is a high-priced house, and that its high prices are justified by the high cost of manufacture and therefore the high value of its meters. The discussion, with a number of significant quotations, is well thought out and carries the idea through to its conclusion in a logical manner.

Trench Pump.—A. S. Marlow, Lincoln Park, N. J., has submitted a bulletin describing the 3 in. and 4 in. single and double "Mud Hog" diaphragm pumps manufactured by them. These pumps are said to be useful for trench work and for pumping out manholes and catch basins, as well as for other and similar duties. The bulletin gives complete specifications for four types of such pumps that they manufacture.

Concrete Pipe, Etc.—Asphalto-Concrete Corporation, 1440 Broadway, New York City, the firm that now controls the patents involved in the Moir-Buchanan process for making concrete pipe, the Bille-Ligonnet process for applying an asphalt lining or surface to concrete pipe or other concrete work, and the Contractor process for making concrete poles and conduits, and who issue rights to manufacture such products under these patents in this country and others, have issued a booklet describing these processes, the advantages accruing from their use, and the possibilities of such products. The booklet, intended to promote further plants and to promote the use of these products, illustrates the processes, the products that result, and a number of successful plants, together with tests that have been performed to investigate the properties of products so made. It makes interesting reading.

Sludge Bed Glass Enclosures.—Lord & Burnham Co., Irvington, N. Y., have distributed a loose-leaf prospectus, specification book and installation list that describes the glass enclosures made by them for sludge beds. The information and illustrations presented in this prospectus on present installations is of interest, while specification data given should prove useful. This literature is bound in an artificial leather cover.

Pumps.—DeLaval Steam Turbine Company, Trenton, N. J., has issued a new bulletin on sewage pumps that contains not only some interesting installation illustrations, but that illustrates and describes as well the features of these pumps that make them of value to the sewage treatment works.

Industrial Notes

The D. C. James Manufacturing Company, Chicago, makers of all types of speed reducers and cut gearing, announce the addition to their sales department of Mr. R. C. Bird, in the capacity of traveling sales manager. Mr. Bird, formerly with the Chain Belt Company of Milwaukee, has spent some twenty years in working with power transmission equipment, and will be available to all interested in securing speed reducers for specialized jobs.

Robbins & Robbins, 801 Tchoupitoulas St., New Orleans, La., have been appointed sales representatives in the states of Louisiana and Mississippi for Graver Corporation, East Chicago, Ind. They will handle Graver's complete line, consisting of water softeners, filters, tanks and steel plate equipment.

Paradon Manufacturing Company, 573 Elm Street, Arlington, N. J., announce the appointment of the Pacific Water Works Supply Co., Inc., Atlantic Street Terminal, Pier A, Seattle, Wash., as their representatives in the sale and servicing of Paradon Chlorinators in the Pacific Northwest. The Chemical Equipment Corporation, 215 West Seventh Street, Los Angeles, Cal., have been appointed in a similar capacity for the States of California, Nevada and Arizona.

The Quigley Furnace Specialties Co., Inc., of New York, manufacturers of Hytempite, Quigley Refractory Gun, Triple-A Solutions, Quigley Acid Proof Cement, etc., announces that Harrison W. Wood has joined their service staff. He will cover the Central South and South Atlantic States. Making his headquarters at Atlanta, Mr. Wood will co-operate with all Quigley agents throughout the Central and South Atlantic States.

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The Role of the Amateur in Scientific Discovery

The history of science bulges with the achievements of amateurs. So striking is this phenomenon that at times it seems almost as if one of the requirements for scientific discovery is initial ignorance. Undoubtedly there are reasons for this anormality, which it may be profitable to seek.

An amateur is one who is not a professional specialist. Hence a specialist in one field usually is an amateur in all other fields of knowledge. Thus regarded, it is seen that Isaac Newton must have been an amateur in nearly all the realms of science that were enriched by his discoveries. He was a professor of mathematics at Cambridge, and he remained an amateur in every other branch of science. True it is that he made some of his most profound discoveries in his own professed specialty. His development of the infinitesimal and integral calculus was an epochal achievement. But equally true is it that he revolutionized astronomy, in which he started as an amateur and remained always an amateur. Except for an occasional peek of curiosity, Newton scanned no stars through telescopes. He was content to take the data and empirical laws of Tycho Brahe, Kepler et al, and, by their suggestive guidance, deduce the law of gravitation together with its most important sublaws. Then he turned to the realm of physics which he enriched with his discoveries in optics and acoustics. He wandered from cave to cliff in many a different scientific realm, everywhere finding new nuggets of knowledge, as amazing in their richness as in their variety. Par excellence Newton was the amateur in science, yet always out stripping his contemporary professionals.

Shall we attribute this merely to genius, that word with which we cloak our ignorance of the methods of the original thinking? Or shall we try to find the principles employed by original thinkers, and the conditions under which original thought is best conducted?

Let us consider some of the conditions that assist the original thinker. One of these clearly is an unbiased attitude, a freedom from old theories that so dominate the mind as to blind it to the truth of new theories. It is characteristic of most professional men that they become exceedingly intolerant of new theories. The longer they believe in an old theory, the more intolerant they are of a new theory that conflicts with the old. While a new, true theory has a marvelous efficacy in solving scientific enigmas, an old, false theory is equally effective in turning the mind away from correct solutions. Here, too, the history of science is replete with examples.

The amateur therefore enjoys a not mean advantage over the professional, in that he is not handcuffed to any corpses. His mind's eye moves freely and quickly over hypotheses; the new being as impartially regarded as the old. He pauses with no sense of "auld lang syne" amid well known theories, but is impressed by them only, in so far as they match and explain the facts of nature. So, new and old theories look much alike to the amateur, whereas to the professional only the old cause him to lift his glass and say: "May you live long and prosper."

Great as is the importance of having a mind not initially biased by old theories, there is a much more important advantage possessed by the amateur researcher, namely the fact that he is instinctively a researcher. If he may be called a "professional" in any sense other than the common sense of earning a livelihood by a given kind of activity, the amateur investigator is a professional researcher. He is an animated interrogation point. Why this? Why that? Why the other thing? Now this characteristic is precisely the one not yet common among men. So it follows that when an amateur who is a researcher by instinct enters any realm of science, he often finds himself almost alone as to originality. What wonder then that his work soon becomes conspicuous. He encounters, of course, the ill concealed skepticism of many professionals, who at first can see in him only the amateur. Witness Louis Agassiz's announcement that he had discovered that an ice-age had existed over Europe not many thousand years ago. Professors of geology were not slow in writing him to "stick to his fishes," piscatology being his profession. Even that great migratory mind, Humbolt, solemnly adjures him not to wander into the realm of geology. But he persisted in

wandering, until he soon had all the world wondering. He had discovered a new fact of undreamed of importance, namely that climate has changed enormously. Indeed this phenomenon is one of the most important factors in biological evolution. Had there been no ice ages there would be no man, and but few of the countless species of animals and plants that now ride this spinning top of time.

Not long before Agassiz's epochal discovery, another amateur, an English county surveyor, had made a geological discovery equally great. William Smith had noticed that fossils in different rock strata differ, and he formed the hypothesis that each formation represented a geological epoch, in which different species of animals had lived. He made the first stratigraphic map ever made, and associated each formation with its characteristic fossils. His friends dubbed him "Strata" Smith, and called him "that crank." But this professional surveyor was destined to evolutionize the science of geology which was then in its infancy.

Stepping forward a century we meet an amateur of the amateurs, a young lad in his teens, not yet decided as to a profession, Luther Burbank. We see him reading Darwin's "Origin of Species," and beginning to wonder whether a man might not be able to create a new species by artificial selection even as nature had created new species by natural selection. We see him resolve to try the impossible. He starts humbly enough by developing the Burbank potato. No horticulturalist, no professsor of biology or botany here—just a New England country-town boy; but he was soon to make the naturalists of the world admit that man at last had rivalled nature by producing an entirely new species of plant.

Willard Gibbs, professor of mathematics at Yale, did not stick to his pure mathematics, but chose to wander into the field of physics where he discovered the "Gibbs phase law" that has been such an invaluable aid to research chemists that it has been termed the philosopher's stone of modern chemistry.

Gregor Mendel, a name long forgotten but now engraved large on the portals of biology, was a monk who did not confine his thoughts to religion, but sought to discover the laws of heredity. Experimenting with flowers, by crossing different strains, he uncovered what is now known as the Mendelian law of heredity.

A large book could doubtless be filled with just such biographical paragraphs as those above, each stating concisely the scientific discovery of some amateur.

Lest it be assumed that we regard the professional expert as being irretrievably handicapped by his expert knowledge, as Henry Ford seems to think, we hasten to add that it is not his knowledge that handicaps him so much as his tendency to rest satisfied with what he knows. Supplement such a tendency with an inclination to regard original research work as being beyond their powers, and you have quite a complete explanation of the paucity of discoveries by professional men.

Two generations ago German teachers of science, particularly chemistry, began to stress training in original research. The results have been so prolific that we may well wonder why American teachers have been so slow in following German practice.

If it be argued that education is primarily designed for the man who is not an original thinker, but for the average man, then the argument assumes that most men lack an instinct for originality, which is a false premise. Original thinking differs not one whit in principle from what is regarded as unoriginal or ordinary thinking, except in degree of originality. In every case of real thinking a problem presents itself for solution, and calls for the gathering of facts, then systematic classification and inferences as to what they signify. It calls also for the memorizing of many of the facts, so that the mind will have material upon which to work; but so far removed from correct understanding of psychology are most of our teachers that they actually inveigh against loading the memory with details, than which no greater error has ever been made. Our Edisons and our Burbanks have always been walking encyclopedias, loaded to the eyes with facts. So, too, are most successful men in every walk of life. It used to be said of James J. Hill that he knew every last penny of railway transportation costs, and the why of every detail. The one time that the editor heard him lecture to an audience of business men who asked him many questions it was the general verdict that they had never heard such a demonstration of the power to remember details. Yet, in the face of innumerable cases of this sort, most teachers go on decrying the teaching of anything much except "general principles." General principles never won even a skirmish without a regiment of those privates that we are prone to belittle as "mere details."

It is by observing some slight similarity between two details of different phenomena that the kinship of the phenomena is first suspected. And it is by marshalling more details that the better known phenomenon serves to guide the investigation to a theory that explains the less well known phenomenon. Exactly the same process leads to success in solving business and professional problems. Hence it is a mistake to think that German training in research work is not the kind adapted to the needs of the average man. Our firm conviction is that it is the only kind of mental training that has much merit. And it is because certain amateurs have been trained or have trained themselves in that manner that they are able quickly to solve original problems in fields that are new to them.

Let it also be noted that it usually requires only a few weeks of intensive reading to master all the theories and facts relating directly to any limited branch of scientific knowledge, and it becomes apparent that an amateur can possess himself of more knowledge about it than most professionals have. Then if the investigator has read widely in science and has remembered much that he has read, he is equipped to attack a problem in that branch of knowledge with excellent chance of successful issue.

H. P. Gillette

An Electromagnetic Whirl Theory of the Genesis of Planets

Explaining Geological and Topographical Formations, Barometric and Climatic Changes

By HALBERT P. GILLETTE

THE genesis of the solar system, and of other planetary systems, will be outlined first. Quantitative laws of planet periods of orbital revolution and of axial rotation will be given next. It will be shown that the great magnetic whirls called sunspots have their counterparts not only in cyclonic storms on the earth, but in whirls that existed in the molten matter of our globe. By their sunspot effects 11 planets have been discovered, several of which have been predicted, and one of which, Vulcan, has even been claimed to have been seen.

These and other phenomena will be shown to be caused by electromagnetic propulsion. Hence it follows that not even gravitation itself has been a more important factor in the architecture of the universe than has been the force called electricity.

It has long been known that electric currents moving in the same direction attract one another, while those moving in opposite directions repel one another, and that under certain conditions electric currents are magnetically rotated. The present article deals mainly with rotating masses, all of which are electrified to some extent by the presence of "free" electrons, and are therefore electromagnets. These may be called electromagnetic whirls, to use a generic term.

A Basic Principle.—It was established in 1876 by Rowland that a whirling metal plate charged with static electricity acts as if an electric current were flowing in circles about the center of rotation. Later, when the electron was discovered, it was evident that whether an electron is attached to a moving mass or is itself moving independently (as along a conductor), an electric current exists, with its concomitant magnetic effects. But, curiously, these facts have been given scant consideration either in the realm of astronomy or of metereology. It is true that Hale has shown that sunspots rotate and are powerfully magnetic, but this very important discovery has remained almost isolated and unused.

The Electron.—Atoms consist partly of electrons travelling in orbits about a nucleus that may itself be nothing else than a very great number of orbital electrons packed into an exceedingly small space. Atoms release electrons, probably from the nucleus, the number released (or made "free") depending upon the kind of atom, the external radiations to which it is subjected, its temperature and the pressure upon it. The higher the temperature and the lower the pressure the greater the number of free electrons.

A Great Force.—Even among scientific men few seem to know how stupendous is electric force compared with gravitative force. The electric attraction of an electron is to its gravitational attraction as $\frac{1}{4} \times 10^{40}$ is to *1;* or the electric force is 2,500,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000 times the gravitative force of an electron. Hence even a very few free electrons in motion may be expected to show enormous power, and they do.

It is probable that no large mass exists that is devoid of some free electrons, and consequently of some electromagnetic force.

Molten whirls, as will be shown, have been the architects that have given to our globe its general topographical form. Air whirls have caused the climatic and weather cycles that, by causing rainfall, have created the sedimentary rocks and carved both the sedimentary and the igneous uplifts into multitudinous shapes.

Were it impossible to support this whirl theory in its every ramification by quantitative facts, it would be only a suggestive hypothesis at best, but the theory is supportable by so many statistical facts that only a small percentage of them can be given in an article of moderate length. However, it is believed that the facts here given will suffice to show that this electromagnetic whirl theory of the genesis of rotating and orbital masses is sound in principle and far reaching in its applications.

Planet Genesis.—As Hale has shown, sunspots are magnetic whirls in the sun's atmosphere. Free electrons tend to move along the lines of force of a magnet, hence it is probable that ionized molecules are similarly propelled. At any rate, it is certain that along the axis of a sunspot material is ejected to great heights, and presumably some of the material thus ejected travels great distances into space, propelled by electromagnetic energy. Some of the material thus ejected would necessarily be halted in its outward flight by the counter pressure of electromagnetic force of other stellar bodies, and would thereafter pursue an orbital path.

If we regard a sunspot as a rifle shooting sundust into space, some of which dust is halted by counter radiations from another sun, three effects become inevitable: First, orbital bodies

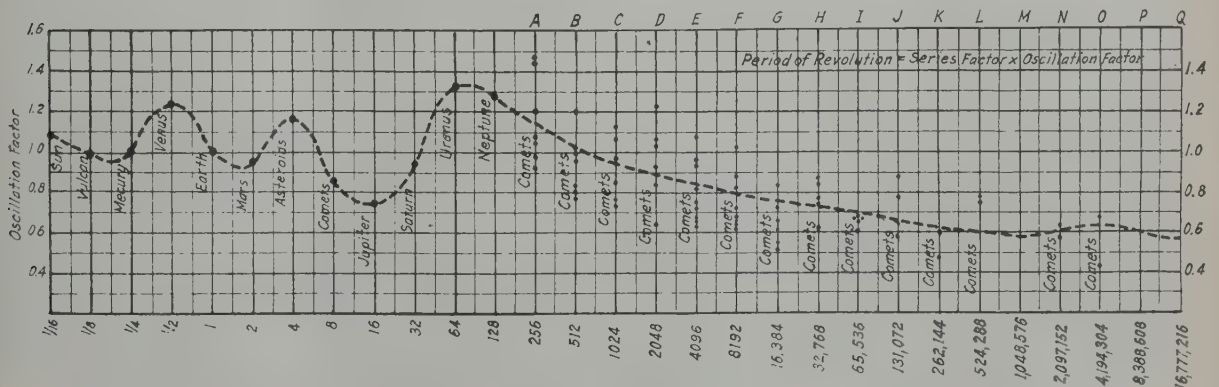


Fig. 1—Curve of Orbital Period

are created between the two suns, and those orbital bodies grow fastest that have orbital periods that are in a geometric series in which the sun's period of rotation is unity, with the orbital period of the first planet double the rotative period of the sun, and the orbital period of each successive planet double that of its predecessor. Second, the diameters of the successive planets in the series must be proportional to their mean distances from the sun, if the process of planet building is not halted, and if the rotative velocity of the generating sunspots remains constant. This means that the diameter of each planet in such a series is such that it exactly eclipses the successive planets and the distant sun. Third, as each planet becomes radiant it acts as a sun itself and halts material ejected from the sun.

Titius-Bode Law.—That some sort of a geometric series of planet distances exists was evident to Titius and Bode, who crudely expressed it in the Titius-Bode law. Unfortunately they made their doubling factor relate to distance, whereas it really relates to orbital period, so their law is but a crude first attempt at a solution of the problem, unguided by any rationalization. Study of the moons and planets shows at once the substantial truth of the geometric series of their periods and it also discloses that in some instances the multiple is 1.5 instead of 2.

The fact that our moon almost exactly eclipses the sun points to the truth of the second generalization; but even more significant is the fact that the diameters of Mercury, Earth and Saturn are very nearly proportional to their solar distances. A similar law is seen to hold approximately as to the moons of the planets.

Another Variable.—There is, however, at least one other variable to be considered, for not all the planets have diameters proportional to their solar distances, nor are their periods exactly double those of their predecessors in the series. A little consideration shows that a variable exists in the varying period of sunspot revolution about the sun's axis, the period of revolution being a function of the latitude of the spot. The empirical law that has been discovered can doubtless be rationalized, for the sunspots (being electromagnets) owe their revolution not only to the sun of which they are a part, but to the electromagnetic field of the sun which must increase in force toward the sun's poles. Likewise the migration of the sunspots to lower latitudes is a result of their propulsion by the sun's magnetic field.

Oscillation Factor.—Since sunspots are generated by planets, as will be shown, and since planets vary periodically in their sunspot effects, and since planets differ as to their respective sunspot generating power, it follows that there must have been a periodic variation both in the number of sunspots and in their average latitude. This, then, introduces what may be termed an oscillation factor that affects the period of revolution of the planets that were generated by the sundust emitted from sunspots. Study discloses that this oscillation factor also follows a geometric series law, of which more will be said later.

Periodicity Chart.—Fig. 1 shows in graphic form the law of planet periodicities, the product of the abscissa by the ordinate giving the orbital period of each planet. The abscissas are shown as a geometric series in which the multiple is 2. The orbital period of each planet divided by its abscissa gives its ordinate or oscillation factor. The curve thus found from Mercury to Neptune was extended beyond Neptune by plotting the positions of 69 comets, which are indicated by dots, and then drawing a median line from *A* to *N*. It was assumed that the points of intersection of this curve with the ordinates *A* to *N* indicate the positions of undiscovered planets on the chart, whose names are designated as *A*, *B*, *C*, etc. The chart (drawn on a larger scale) indicates that planet *A* has an orbital period of $1.14 \times 256 = 291.84$ years. It was found that Lowell had predicted a planet of about 290-year period, and that Flammarion had predicted one of 300-year period. As will be shown later, planet *A* has produced sunspot maxima every 290 years and its orbital period is 295 years.

At the beginning of the curve in Fig. 1 is shown the sun's period of rotation. Then comes Vulcan, whose period was first calculated and later found to be almost exactly in accord with certain sunspot maxima.

A Geometric Series.—Study of the curve from *A* to *K* disclosed that if the ordinate of *K* is subtracted from each of the preceding ordinates, the remainders form a geometric series in which each number is double the predecessor. Although the median curve from *A* to *K* was drawn by eye, its ordinates fit very closely the geometric series just given. When later conclusive evidence was obtained as to the existence of planets *A*, *B*, *C*, *D*, *E*, *H*, *M*, *N*, *P*, *Q*, no doubt remained as to the law of geometric series both for the ordinates and for the abscissas of the curve in Fig. 1.

The oscillation factor (or ordinate) for planets *A* to *M* is given by the formula:

$$(1)\quad f = 0.56 + (.05 \times 1.25^{n-1})$$

n is the serial number of the planet by counting backward from *M* to *A*, calling planet $L=1$, $K=2$, $J=3$, etc.

Regarding the oscillation factors of the other planets, discussion is reserved for another article.

Law of Planetary Rotation.—The heads of comets contract as they near perihelion, indicating the effect of increased electromagnetic force resulting from the liberation of more electrons under the stronger radiations from the sun. Such contraction would necessarily be accompanied by increased rotative velocity. Similiarly the embryonic planet must attain a rotative velocity that is a function of the electromagnetic forces acting upon it. Since the number of lines of electric force that a planet cuts is a function of its orbital velocity (v) and the velocity with which the generating sunspots revolve about the sun's axis, which finds measurement in the oscillation factor (f), a formula for the period of planet rotation (p) should be a function of f and v. As a matter of fact, as shown in Table IV, the following formula gives fairly close results for all the planets whose rotative periods are known:

$$(2)\quad p = 2.86\, f\, v^{\frac{3}{4}}.$$

p=period of rotation, hrs.
f=oscillation factor.
v=orbital velocity, miles per sec.

Using this formula, assuming f to be constant, and introducing the law of diameter variation with distance, the Leavitt-Shapley law of absolute magnitude of the variable stars is readily deduced. This leads to the very important inference that the entire stellar system was probably generated by electromagnetic whirls, very much as the solar system was generated.

The Law of Sunspot Periodicity.—The electromagnetic whirl theory indicates that when the magnetic axis of a planet points most directly toward the sun, the greatest number of sunspots will be produced. Taking the Earth as a typical planet, it undoubtedly has two major magnetic axes: First, the one due to the rotation of the earth on its axis; and, second, the one due to the westward air current at altitudes of 20 miles and more. At high altitudes there is an eastward moving shell of highly ionized air that encircles the globe. It creates two whirls, one centering near the south pole, which is an ascending or cyclonic whirl, and one centering near the north pole which is a descending or anticyclonic whirl. This upper current of negatively charged air generates the upper magnetic field whose poles are slowly rotating westward around the axial poles of the globe. A similar magnetic field doubtless exists in the sun's upper atmosphere, for Hale has discovered that the sun's magnetic axis is also inclined and that its poles are slowly rotating. Since the number of free electrons is an inverse function of pressure, the ionization of the air increases rapidly with altitude. Consequently the electromagnetic field caused by the giant air-whirl must be very powerful. If we assume that these two magnetic axes do not coincide, and that the poles of the giant air-whirl rotate slowly westward, then it becomes evident that the maximum number of sunspots caused by the Earth will occur at intervals of less than 12 mos. By studying a curve of daily sunspots the writer found a sunspot period of 10.76 mos., which was provisionally assigned to the Earth. The well known so-called 11 yr.

sunspot period was assigned to Jupiter. It was found to be 11.207 yrs., whereas Jupiter's orbital period is 11.86 yrs. Similarly sunspot cycles were found and assigned to each of the other planets. Before the task was completed it became evident that the spread between a planet's period of revolution and the sunspot period assigned to the planet is greater the greater its orbital velocity. This led to the discovery that the following formula fits very closely the sunspot period assigned to each planet:

(3) $t=T\ (1-0.007\ v)$.

t=sunspot period due to a planet.
T=orbital period of the planet.
v=orbital velocity, miles per sec.

Table I shows how closely this formula fits the facts.

The Effect of Mars.—Study of the maximum number of sunspots corresponding to the different planets disclosed that Mars, although much smaller and farther from the sun than Venus and Earth, produces more sunspots. But this is what the electromagnetic theory might lead us to expect, for the axis of Mars is much more inclined than theirs, and therefore points more directly toward the sun. Axial inclination also explains why both Uranus and Neptune produce greater sunspot effects than Jupiter. Neptune's effects are about the same as those of Uranus; and Saturn's effects are much smaller, which is to be expected because its axis is but slightly inclined.

Since the Earth has two great magnetic fields, their combined effects are greater at intervals longer than 10.76 mos. The same is true of other planets, but this is a detail that need not be discussed now.

Table II shows the sunspot period assigned to each planet, and one of its relatively recent peak periods.

Table III shows sunspot peak years since 1615 A. D., and the peak periods of Jupiter, Uranus and Neptune. Planet *A* caused the sunspot peak of 1778; planet *B* caused the peak of 1847.

The writer has located the effects of more than a score of comets. Schuster's three sunspot periods of 4.8, 8.4 and 13.5 yrs. are assignable to the comets of 1819 IV (Nov. 20), 1889 VI (Nov. 29) and 1885 IV (Sept. 11).

Sunspot Cycles and Tree Growth.—Douglass was the first to demonstrate that the 11-yr. sunspot cycle frequently causes a corresponding cycle in the radial growth of trees. Huntington has shown that climatic changes have corresponded with a grand swing of the curve of growth of sequoia trees. Using the tabulated growth data gathered by Douglass and Huntington, the writer has been able to determine the sunspot cycles assignable to all the planets from Jupiter to Neptune. Using the same data, the cycles of planets *A*, *B* and *C* were discovered, and that of *E* was indicated. Baron de Geer's annual clay-varve chart was next used to supplement and greatly extend this investigation.

Sunspot Cycles and Clay-Varves.—The annual layers of clay deposited in ancient glacial lakes and in fiords have served, as above stated, to disclose the sunspot cycles of many planets. For 50 years Baron de Geer has been measuring and counting these clay-varves until he has produced a varve chronology that runs back more than 18,000 yrs., constituting one of the most remarkable of scientific achievements. The 11-yr. sunspot cycle is to be seen repeatedly in his charts. The writer has found many other cycles, and by their aid has been able to ascertain the date of de Geer's "zero year." The method of fixing its date was as follows:

The sunspot period of Uranus is 81.15 and that of Neptune is 161.57 yrs. Two of Uranus' cycles differ from one of Neptune's by 0.73 yrs. Since their last sunspot peaks were in 1837 and 1870, or 33 yrs. apart, it follows that they would occur together in $33\div 0.73=45$ cycles of Neptune back from the year 1837. On the clay-varve chart there is a Uranus peak at —1185 and a Neptune peak at —1173, or 12 years apart. Adding the 12 to the 33

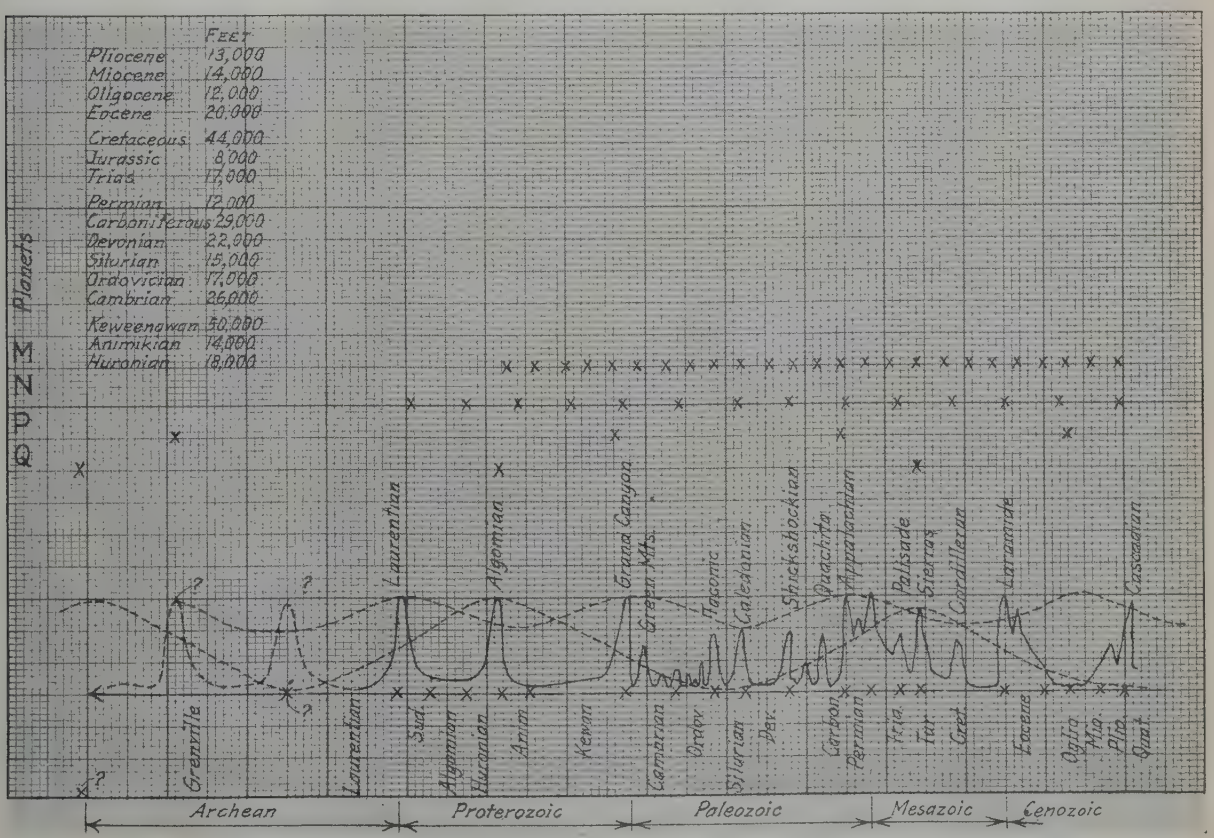


Fig. 2.—Eras, Periods and Upheavals and the Cycles of Planets M, N, P, and Q

yrs. we have 45, which divided by 0.73 gives 61, which is the number of Neptune cycles back at the year 1837 to the year —1173; hence 61×161.57= 9856, thus making de Geer's year —1173 to be 9856—1837=8019 B. C., whence de Geer's zero year is 8019—1173= 6846 B. C. There was a recent gap in the clay-varve series that de Geer had been compelled to estimate, and he had estimated that his zero year was about 6800 B. C., which he believed was within one or two centuries of the correct date. It will be seen that he missed it by only 46 years.

Using the sunspot period of planet *A*, which is 289.97 yrs., the writer secured the very same date for de Geer's zero year, namely, 6846 B. C., so there is no doubt as to its correctness.

The method of "triangulating" backward in the time scale, can doubtless be used to determine the exact age of any series of clay-varves, no matter how ancient. Since clay-varves exist at the beginning of the Huronian period, it will be feasible to carry an accurate chronology back for fully 15,000,000 yrs. of geological history.

Sunspot Cycles and Geological Strata.—Noting the frequent recurrence of a thickness of sedimentary rock of about 12,000 to 15,000 ft. in different geological periods, the writer inferred that the length of those periods might have been determined by a planet of very long orbital period. Starting with this clue, it was comparatively easy to develop a theory of stratification that fits the facts remarkably well. In very brief outline, it is as follows:

Fig. 2 is a chart reduced to one-quarter the scale of the original chart, and therefore not as satisfactory for purposes of proof; but the reader can readily plot a chart to a larger scale. In the chart the tabulated strata thickness of 16 periods is taken from Brooks' "Climate Through the Ages," p. 423. It will be noted that 6 of the 16 periods have a thickness that approximates 13,000 ft. Reed (The Varved Clays at Little Ferry, N. J.) states that the 2,500 annual clay-varves measured by him at Little Ferry have an average thickness of about 3/16 in., although the range is 1/16 to 1 in. Based on this average a foot of clay indicates 64 yrs. While there is a wide range of clay deposited between extreme years, it may be assumed that for a grand cycle of, say, half a million years, there would be a rather constant rate of erosion over great areas. Since the total thickness of sedimentary rock deposited in any geological period constitutes an integration of innumerable oscillations in rainfall, slope, temperature, etc., it is a fair presumption that such thicknesses form the best criteria of the time involved in the deposition of the strata. And until the recent use of the uranium-lead formula, this was the commonly accepted criterion, modified only by the use of "judgment." The uranium-lead formula gives results so widely differing from all others that it is open to the gravest doubt. Moreover it starts with assumptions that are unsupported by any facts.

Rate of Formation.—As a first approximation, if we assume that each foot of rock represents about 60 yrs. when taken over an entire period, we find that for a layer 13,000 ft. thick it gives a period of 780,000 yrs. The planet nearest to this period is planet *M* (Fig. 1) with an orbital period of about 587,000 yrs., its sunspot period being but very slightly (0.15 per cent) less, according to Eq. 3.

Since the Animikian period has strata thickness totaling 14,000 ft., which is just the same as that of the Pliocene, and since there are 286,000 ft. of rock between the beginnings of those two periods we have 21 cycles of planet M, each measured by 12,860 ft. of rock. But 586,000÷12,860=45.57 ft. of rock per annum. This was the second approximation in the problem of determining the chronology of the geological periods. Upon plotting this distance on a chart to a scale 4 times that of Fig. 2, and after locating the effects of another planet, *N*, in similar fashion, the value of planet *M* was slightly modified, making it 12,880 ft. of rock covering a period of 586,000 yrs., or 45.6 yrs. per ft. of rock.

Incidentally this time scale is about half as long per foot of rock as one that has been used by many geologists who have based sedimentary rock ages on present rates of erosion. But de Geer proved conclusively, by his clay-varves, that the age of the Niagara Falls gorge is only 40 per cent of the shortest age assigned to it by present rates of erosion, so our results are in general accord with his as to the lesser rate of present-day erosion. It should be remembered that the average slope of the ground surfaces was undoubtedly greater than at present, and that even a slight increase in slope greatly accelerates the velocity and erosive power of water.

The small crosses on the chart, Fig. 2, opposite planets *M* and *N*, indicate the dates of the peak affects of those planets on sunspots and on rainfall. The writer infers that even in the case of snowfall, during ice-age periods, the greatest erosion followed the winters of greatest snowfall.

The periods of planets *P* and *Q* (Fig. 2 and Table II) were determined by the periods of great continental uplifts. The Cascadian period occurs in a valley of the sunspot curve caused by planet *Q*, but the same is true of the Taconic and Caledonian uplifts. This anomaly is explained by the fact that the polarity of sunspots often changes at about the time of a sunspot minimum. A change in sunspot polarity produces corresponding changes on the earth.

The planet *M* has an orbital period of 587,000 yrs., which is only 19 per cent in excess of the 494,000 yr. period of a planet whose existence Pickering predicted. Pickering's method consists in finding the "mean argument" of aphelia of a group of planets (Annuals of Astr. Obs. of Harvard, Vol. 61, p. 166, yr. 1911). Pickering predicted a planet of 26,000-yr. period, which corresponds roughly with that of planet *H* (22,180 yrs.) and he predicted a planet of 13,038-yr. period, which corresponds roughly with that of planet *G* (11,600 yrs.). He made several other predictions, and all but the first one just named range from 10 to 30 per cent above the true periods. This indicates that most of the comets have lost velocity since they were generated.

Fourteen Giant Whirls on the Earth.—Sunspots have minor maxima once every rotation of the sun on its axis, or an average of about every 27.2 days as viewed from the earth. Also a daily sunspot curve shows other periods of about ⅛, ¼ and ½ of 27.2 days. This indicates that sunspots are more numerous along certain meridians. This phenomenon resembles the geometric figures that small floating magnets form under the influence of a powerful magnetic field. Hence sunspots, which are magnets, probably tend to assume a geometric grouping, under the influence of the sun's magnetic field and their own fields. Incidentally this may explain the arrangement of the "centers" on Mars from which the "canals" radiate to other "centers"; also the grouping of "craters" on our moon.

Such geometric groups led to a search for similar groupings of whirls in our atmosphere, several of which were quickly found on charts of the movements of clouds at elevations of 5 to 7 miles. When the centers of those whirls were plotted on a large map, it became apparent that they were also centers of similar whirls that had existed in the molten matter of the earth. Fourteen such centers were located, one about 8 deg. from each of the poles, six near the equator (three in each hemisphere), three near the arctic and three near the antarctic circles. Table V gives the approximate latitude and longitude of the center of 12 of these giant whirls, and their direction of rotation.

These 14 giant cyclonic air whirls ascend to levels somewhat above the level of the cumulus clouds, and there bend over, descending as anticyclonic whirls. These 14 anticyclonic centers at the earth's surface lie to the west of the corresponding cyclonic centers and in much higher latitudes. There is a periodic shifting of these 14 anticyclonic centers, the shift being to higher latitudes at times of greater relative intensity of sunspots of south polarity.

A study of the topography around each of these 14 centers at once reveals the fact that although the centers have remained practically stationary since the dawn of geological time, the whirls about these centers have varied in diameter, and that the whirls have been annular belts that were relatively narrow, belts of land elevation alternating with belts of depression.

What the Map Shows.—Only one map, Fig. 3, is here given to illustrate these whirls; and it is not the best map for the purpose of showing the truly remarkably circular topographical features of the globe. If the reader will locate center *A* near Timbuktu, Africa, he will find that the north western coast of Africa lies on a circle about that center for half the diameter of the circle. Similarly as to north western coast of South America about center *D*. Similarly as to the south eastern coast of Australia about center *E*. Another center, *B*, is noteworthy for the remarkable circular chain of islands (Sumatra, Java, etc.) about it; center *B* is in the Philippine Islands.

Although maps having the meridians drawn in straight lines, that converge toward the poles, serve fairly well for study of these 14 giant whirls, an 8-in. globe will be found much more satisfactory.

Fig. 3 shows two whirl centers, *a* and *b*, about which whirls *a1* to *a5* and *b1* to *b6* have been drawn. Other whirls about centers *A* and *D* are shown. Whirl *A2*, for example, marks the backbone of the Rocky Mountains. About midway between whirls *a1* and *a2* lie the Alleghenies and the Appalachian Mountains. Contrast those two whirls of land elevation with the great whirl of depression, *b3*, which sweeps through the Great Lakes and the string of large lakes in Canada. This same whirl of depression passes through the centers of the Mediterranean and the Black Seas.

Even relatively small depressions (or elevations) frequently lie in series on these giant whirls. Note, for example, San Francisco Bay, Great Salt Lake, and Lake of the Woods, all on whirl *a3*.

Where two whirls of elevation intersect, an exceptionally great elevation frequently occurs; and a similar strengthening of effect often occurs where two whirls of depression intersect. This indicates that like whirls reinforce one another, whereas unlike whirls tend to nullify one another.

An Effect of the Planets.—It is evident that the belts of whirling molten matter rose or fell, depending upon their polarity, that is the direction of rotation, acting under the influence of the electromagnetism of the earth itself, of the giant air whirl whose axis terminates near the poles and of the sunspots and sun. That these giant whirls vary in intensity, and therefore in diameter, under the influence of sunspots, is hardly to be doubted. If then

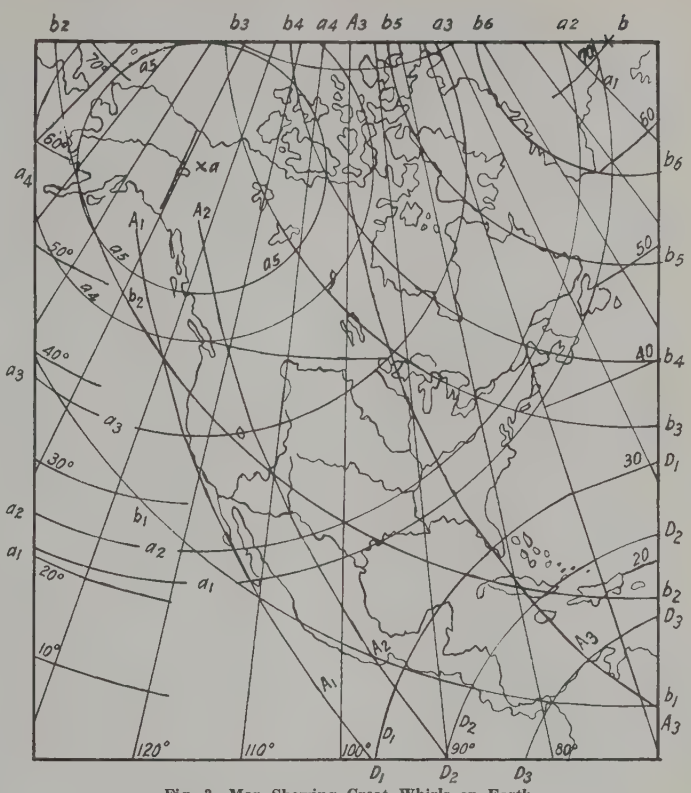


Fig. 3—Map Showing Great Whirls on Earth

the sunspots come in cycles caused by the planets, it follows that the great planets *M*, *N*, *P* and *Q* have been the cause of repeated periodic rise and fall of land along certain belts of the earth. Incidentally this explains the great outflows of lava at about the beginning of geological periods and eras. It also explains the relative permanence of the elevated and depressed regions.

Since the giant whirl whose axis lies near the poles, has opposite polarity at the two poles, we should expect to find a general elevation of land at one end and a depression at the other. This is exactly what we find—a great antarctic continent and a great arctic sea. Incidentally the exceptionally low barometer (an inch below average) that exists within the arctic circle finds complete explanation by the electromagnetic whirl theory. Many other barometric riddles are readily answered by this theory, but space forbids discussion of them now.

The Earth's Interior.—Although most geologists have abandoned the old theory that the interior of the earth is still molten, it seems to the writer that the old theory is sound. Otherwise a change of land elevation of 1,000 ft. since the last ice age (only 8,800 yrs. ago, according to de Geer's unimpeachable clay-varves) is not explainable on any hypothesis that fits well with other established facts. Incidentally it was not relief from the weight of the ice cap, but electromagnetic propulsion that caused these land elevation changes. In fact it is the very same electromagnetic motion of the fluid interior that probably explains the well known periodicity of earthquakes and volcanic eruptions. Even the small 11-yr. effect of Jupiter's sunspots has a marked relation to earthquake frequency.

Numerous Other Whirls on the Globe.—Since the lunar "craters" are probably solidified electromagnetic whirls of molten matter, and since there are a great many of them, it is a natural inference that numerous whirls existed in the molten earth. Even casual inspection discloses many. One evidently caused the Lesser Antilles, and two others not far away produced the reversed curve that forms the Isthmus of Panama. The Florida Keys were similarly formed, and so was the Gulf of Mexico from New Orleans to Yucatan. The Alaska Peninsula and the Aleutian Islands lie on the arc of a circle; so do Cape Horn and the Falkland Islands.

The iron deposits of the Great Lakes lie mostly along circles whose center is about 50 miles west of Milwaukee. One of these same whirls outlines also the western edge of the Illinois coal field. It is noteworthy that five of the six main coal fields of Texas lie close to a circle whose center is the same one that was above referred to as the center of the Gulf of Mexico. Both contours and mineral zones are so frequently found to lie along circles that

Table I—Theoretical and Actual Sunspot Cycles Attributable to 8 Planets

	Cycle		Per cent
	Theoretical	Actual	Difference
Mercury	69.65 days	68.64 days	+1.5
Venus	190.7 days	201.5 days	—5.0
Earth	10.44 mos.	10.76 mos.	—3.1
Mars	20.21 mos.	19.50 mos.	+3.5
Jupiter	11.19 yrs.	11.21 yrs.	—0.2
Saturn	28.24 yrs.	27.72 yrs.	+1.9
Uranus	81.35 yrs.	81.15 yrs.	+0.3
Neptune	160.97 yrs.	161.57 yrs.	—0.4

Note: The "theoretical period" was deduced by the formula t=T (1—.007 v), in which t= sunspot period, T=orbital period, v=orbital velocity in miles per sec.

this part of the theory discloses strong prospect of its immediate application in the search for coal, oil, iron ore, etc.

The ocean "deeps" were probably whirls of depression, and their resemblance to the circular "oceans" on the moon is thus explained. The "craters" on the moon were probably small whirls of molten matter.

Sunspots and the Magnetic Needle.—Since there are probably several powerful magnetic whirls in the earth, if it is still fluid inside, we should expect to find a rather complex behavior of the magnetic needle, which is the case. The astronomer Halley inferred the existence of two north and two south poles, and he explained them by an hypothesis of two rotating magnetic spherical shells within the earth. Like many another rejected theory, it may be revived and found to be useful. We have only to substitute a "shell" of highly ionized air for one of his earth "shells," to see that Halley's hypothesis may be essentially correct. If we add thereto some of the 12 other giant whirls, and probably some of the smaller whirls, it should be feasible to derive a very complete theory of earth magnetism in so far as it affects the magnetic needle. Even such variations as those that occur daily seem to fall into line with the theory; for the rays of the sun, particularly ultra-violet rays, ionize the air, and thus produce daily variations in the intensity of the electro-magnetism.

Whether the sunspots act directly on the earth, or indirectly through the change in ultra-violet radiation, it is certain that the magnetic needle shows periodicities corresponding with sunspot periodicities. The same holds true as to radio receptivity.

Sunspots and Weather.—No one can read carefully even a small part of the literature on sunspots without seeing that weather is, at least to some extent, influenced by sunspots. However, there are so many exceptions to the rule that rainfall varies with sunspot activity that not a few investigators doubt whether prognostications of weather, based upon sunspot activity, can ever become trustworthy. Remembering that if even but one physical variable remains unknown, no universally applicable law is likely to be discovered, an investigator should hesitate in predicting the impossibility of long distance weather forecasts. That there have been several unsuspected variables in this problem is evident from what has preceded. For example, it now appears that there are 14 giant whirls on the earth, and that their size is variable and that the direction of whirl of some of them may change periodically. This explains why sunspots may cause cyclonic storms in one belt of the earth, while at the same time causing dry weather in a nearby belt. It also explains the migration of certain storm belts to higher latitudes during periods of sunspot peaks.

Hale discovered that sunspots usually travel in pairs, and are of opposite polarity. Also he found that the leaders of the pairs are the most powerful, and that the leaders are usually of opposite polarity in the two hemispheres, yet only one meteorologist, Father Jerome S. Ricard, has put this fact to practical use, so far as the writer knows.

Polarity of Sunspots.—The writer finds that it is not the number of sunspots that determines the amount of rainfall, but that it is the preponderance of sunspots of one polarity over those of the opposite polarity, the preponderant polarity rotating in the same direction as the rotation of the cyclonic storms on the earth. This fact, taken with Hale's discovery of periodic reversal of polarities (i. e., direction of rotation), explains many of the anomalies of weather. Similarly it explains such anomalies of climate as were mentioned when discussing planet *Q*.

Of course the number of sunspots is only a rough measure of their magnetic effects, so that future investigations will be needed to determine the functional relation between number of spots and magnetic effects on the earth. In addition to which there is still another factor that the writer has not seen mentioned, namely, the direction of the axis of a sunspot relative to the earth.

Sunspots of south-polarity cause a liberation of electrons and a consequently increased electrification of the air. This increases the intensity of all cyclonic air whirls, with consequent lowering of barometric pressure and increased rainfall within the cyclonic areas. That the sunspots of south polarity rotate clockwise is indicated by the fact that when the south pole of the sun points most nearly toward the earth (Mar. 8) there is an increase of atmospheric electrification on the earth; and since the sun rotates clockwise when viewed from the south (anti-clockwise when viewed from the north), it follows from the electromagnetic theory, that a clockwise rotation causes greater electrification of the air. Since barometric pressure falls where such electrification increases, it follows that cyclonic activity increases and is the cause of the reduced air pressure. With reduced cyclonic activity the 14 giant anticyclones associated with the 14 giant cyclones subside in intensity, and rain storms then become more prevalent in the 14 anticyclonic areas.

The leader of a pair of bipolar sunspots is the cyclonic sunspot, and is the more powerful of the two in its electromagnetic effect. Hence in speaking of the polarity of sunspots, it is the polarity of the leaders that is commonly meant. At the present time (1928) the sunspots in the southern hemisphere have a south polarity and an inferred clockwise rotation. This will continue until about 1933 when the new cycle of southern sunspots will begin to have a north-polarity, according to Hale's law of reversal of polarity.

The relative number of sunspots in the sun's two hemispheres changes periodically. The writer has found that these periods are determined by the positions of the more powerfully magnetic planets, notably Neptune and Uranus, with reference to the plane of the sun's equator. When Neptune, for example, is north of the sun's equatorial plane, then it generates more sunspots in the sun's southern hemisphere than in its northern hemisphere. In general, a planet generates the most sunspots on the area of the sun most remote from the planet. Combining this principle with that of Hale relative to the periodic reversal of sunspot polarity, it becomes feasible to ascertain the periods during which the maximum electrification and minimum barometric pressure are produced in the earth's air.

There has long been observed a tendency for a 5.6 yr. rainfall cycle to occur in areas where the 11.2 cycle occurs. This is now explanable. At

Table II—Sunspot Cycles Attributable to 19 Planets

Planet	Series Number	Length of Cycle	Date of Sunspot Peak
Vulcan	1	29.49 days	Nov. 25, 1927
Mercury	2	68.64 days	Aug. 18, 1927
Venus	3	201.5 days	May 25, 1927
Earth	4	10.76 mos.	Sept. 15, 1927
Mars	5	19.50 mos	Jan. 18, 1927
Jupiter	8	11.21 yrs.	Aug. 12, 1917
Saturn	9	27.72 yrs.	Aug. 30, 1924
Uranus	10	81.15 yrs.	July, 1870
Neptune	11	161.57 yrs.	Jan., 1837
A	12	289.97 yrs.	May, 1778
B	13	512 yrs.	Oct., 1847
C	14	951 yrs.	1019
D	15	1,835 yrs.	1856
E	16	3,213 yrs.	420 B. C.
H	19	22,180 yrs.	7,919 B. C.
M	24	586,000 yrs.	293,000 B. C.
N	25	1,278,000 yrs.	521,000 B. C.
P	27	5,113,000 yrs.	1,524,000 B. C.
Q	28	9,390,000 yrs.	5,355,000 B. C.

Table III—Dates of 28 Sunspot Maxima and the Sunspot Periods of 3 Planets

Actual Sunspot Peak	Smoothed Curve Peak	Jupiter Period (11.21 yr.)	Uranus Period (81.15 yr.)	Neptune Period (161.57 yr.)
Year	Year	Year	Year	Year
1615		1614.9		
1626		1626.1	1627.9	
1639		1637.4		
1649		1648.6		
1660		1659.8		
1675		1671.0		1675.5
1685		1682.2		
1693		1693.4		
1705		1704.6	1709.1	
1718.2		1715.8		
1727.5		1727.0		
1738.7		1738.2		
1749.9	1750.3	1749.5		
1761.4	1761.5	1760.7		
1769.7	1769.7	1771.9		
1778.4	1778.4	1783.1		
1787.9	1788.1	1794.3	1789.3	
1804.9	1805.2	1805.5		
1817.3	1816.4	1816.7		
1830.3	1829.9	1827.9		
1836.9	1837.2	1839.1		1837.1
1847.8	1848.1	1850.3		
1860.5	1860.1	1861.6		
1870.4	1870.6	1872.8	1870.5	
1882.3	1883.9	1884.0		
1893.6	1894.1	1895.2		
1907.2	1906.4	1906.4		
1917.6	1917.6	1917.6		
	1928.8(?)	1928.8		
	1940.0(?)	1940.0		
	1951.7(?)	1951.2	1951.7	

Note: Daily sunspot numbers are available since 1748, also monthly and yearly averages. Prior to that only the years of maximum and minimum sunspot numbers are available, and those back only to 1610.

such intermediate periods of increased rainfall during a minimum number of sunspots, sunspots of south-polarity predominate in marked degree over those of north-polarity.

Failure to realize that sunspots of south-polarity are the cause of barometric lows, has been at the bottom of much of the confusion relative to the relation between sunspots and weather. Coupled with confusion on this matter has been the confusion arising from failure to see that there are 14 giant non-migratory cyclones with their consequent 14 anticyclones.

As will be indicated later, the axis of a sunspot ordinarily is not radial with the sun, but it points backward in the leading sunspot of a pair, and forward in the following sunspot. This explains why sunspots produce their greatest effects when near the edges of the sun. It explains several other phenomena of a "lagging" nature.

U-Shaped Whirls.—Any whirling gas or liquid that is also advancing tends to bend. If it bends backward sufficiently an ascending cyclone descends as an anticyclone, forming an inverted U. Then if it breaks at the bend, there appears to be two independent whirls turning in opposite directions. This is the writer's explanation of the pairs of sunspots of opposite polarity. The alternation of low and high barometric centers that travel across any continent from west to east are similarly explainable. They are not only rotated electrically but propelled electrically eastward and toward the equator, as are sunspots. Incidentally, Clayton's law of cyclonic storm migration finds explanation by this theory. The more powerful leader of a pair, the cyclone, tows the anticyclone after it.

Table IV—Axial Rotation Periods of 6 Planets, Actual and by Formula $p=2.86fv^{3}/_{4}$

	v	f	p, hrs.	Actual, hrs.	Difference
Earth	18.52	1.00	25.4	24.0	+ 6%
Mars	15.00	0.94	20.6	26.6	—22
Jupiter	8.12	0.74	10.2	9.9	+ 3
Saturn	6.00	0.92	10.1	10.2	— 1
Uranus	4.24	1.31	11.1	10.8	+ 3
Neptune	3.40	1.27	9.1	7.8	+16

In a whirl belt or zone of rising air, such as one of the 14 giants above named, there develop small whirls, which ascend and bend over. The rising warm air tends to lose its moisture by precipitation; and, becoming cold, descends as dry air in an anticyclone. It is this descent of anticyclonic air that explains the lowering of temperature in storm belts. Where the cyclones and anticyclones are made sufficiently large and strong by intense sunspot activity, an ice-age develops. This explains the coincidence of ice-ages and great land upheavals, for both are the effects of a common cause.

Ocean Currents.—The electromagnetic whirl theory explains ocean currents better than does the prevalent theory that they are the effects of winds. While it is true that winds and ocean currents have much in common as to their general motion, study discloses many motions that differ to such an extent that the wind hypothesis of ocean propulsion seems to be insufficient. Let ocean currents be studied with respect to the 14 whirl centers, and they will be seen to find better explanation.

Convection Currents Inadequate.—Although meteorologists have usually regarded weather changes as being almost completely explainable as due to heat differences, there has been accumulating a mass of facts that have not found explanation in the convection theory. Huntington has stressed the fact that climatic changes are kin to weather changes. He has suggested the possibility of electric forces as causes of weather and climatic changes. But having only one fairly well established sunspot cycle, namely, the so-called 11-yr. cycle, and with no established theory of the cause even of that one cycle, it was not feasible for him to carry his hypothesis far. However, his books were of great help to the writer, for they contain many facts and relations between facts that became highly significant once a definite hypothesis had been framed. The same is true of many of the facts in Clayton's "World Weather" and in Brooks' "Climate Through the Ages."

Huntington's great conception of climatic changes as results of stellar influence was not correct in that he had in mind stars instead of planets. Yet such rational gropings after truth often are extremely suggestive guides to men who come later in search of the cause of things. All creative thinking is of that type. The slightest likeness between two phenomena may be the first clue to a great kinship.

Table V—Locations of the Centers of 12 Giant Whirls

Whirl Center	Latitude, Degs.	Longitude, Degs.	Direction of Whirl
A	18 N	4 W	Clockwise
a	64 N	136 W	Clockwise
B	16 N	121 E	Clockwise
b	68 N	22 W	Clockwise
C	8 N	180 W	Clockwise
c	64 N	76 E	Clockwise
D	2 S	67 W	Anti-clockwise
d	69 S	174 W	Anti-clockwise
E	29 S	144 E	Anti-clockwise
e	69 S	30 W	Anti-clockwise
F	9 S	140 W	Anti-clockwise
f	70 S	68 E	Anti-clockwise

The writer does not agree with those who insist upon complete proof of a theory before publication. Had Fitzgerald not suggested the hypothesis that matter contracts in the direction of its motion, Lorentz would never have deduced the contraction of electrons; and had this deduction not been made, there would have been no Einstein theory of relativity. After even one such episode in scientific history, no one should attempt to weigh the value of any embryonic scientific hypothesis, and find it worthless merely because it is but an embryo.

Sunspots, Ice Ages and Evolution.—When Agassiz published his ice-age theory, Humboldt wrote to him saying: "Agassiz, you should stick to your fishes." Fortunately for geology Agassiz did not stick to his fishes, nor William Smith to his surveying compass, nor Hutton to his pills. The secrets of nature are not infrequently more evident to the amateur than to the expert; for the expert's eyes are often diverted from the truth by a long accepted theory that is false. False theory is as misleading as true theory is enlightening.

From the electromagnetic theory it is to be inferred that ice-ages have marked the apex of every geological era. It is no mere chance that each great ice-age has ushered in a host of new species, and has wiped an older host off the slate. The new living conditions caused by such great climatic changes have killed off those species that either could not accommodate themselves quickly enough or could not migrate far enough. Enforced migration, during the ice-ages, has led to the crossing of different strains of the same species which, as Burbank discovered, results in many extreme departures from type. This greatly accelerates evolution.

Man himself would still be unevolved were it not for ice-ages, and therefore for sunspot cycles, and therefore for planets as yet unseen. Although unseen, many planets make themselves evident by effects that are visible, just as is the case with atoms and electrons.

Planet *E*, whose sunspot period is 3,213 yr., was one of the causes of the last ice-age, which reached its apex 6846 B. C. Planet *E* also caused the cold, wet period that reached its apex 420 B. C. It is also responsible for

the drought period, whose extreme was about half its period or 1607 yrs. later, 1187 A. D. Since then there has been an upward trend in rainfall, affected, of course, by the sunspot cycles of the lesser planets.

Planet H, whose period is about 22,000 yr., cooperated with planet E, and both were aided by the great planet Q.

Climatic Changes.—As Huntington correctly inferred, climate shows periodic changes that are merely weather changes on a greater scale, both of intensity and duration. We may therefore expect ice-ages to come again, and, with their coming, to affect life on the earth as profoundly in the future as it has been affected in the past. But by study of past effects, guided by a correct theory, man will be able to forecast accurately the next ice-age, and thus will be able to prepare for it far in advance by moving to spots where genial climates will exist. Long before that event, electrical engineers will have learned to apply the whirl theory in countless ways, and will have discovered how to bend to man's service the vast magnetic whirls above and beneath the earth's surface. Geologists will have learned how to predict earthquakes and volcanic eruptions, and, what is vastly more important, will have discovered the laws that determine the location of mineralized belts. Astronomers will have reduced the forecasting of sunspot changes to an accuracy comparable with the forecasting of eclipses; and guided by such knowledge, meteorologists will have attained to almost equal precision in foretelling the weather far enough in advance to guide the farmer in his crop plans and the engineer in his location and design of hydraulic works.

Bethlehem Rolling New Sections

Bethlehem Steel Company, which recently added to its line of structural shapes a series of 33-in. beams and girders, now announces the rolling within the past few weeks of a series of 36-in. wide-flange beams and girders at its Lackawanna plant, Lackawanna, N. Y. These new sections are the deepest, heaviest and strongest beam sections produced in the United States.

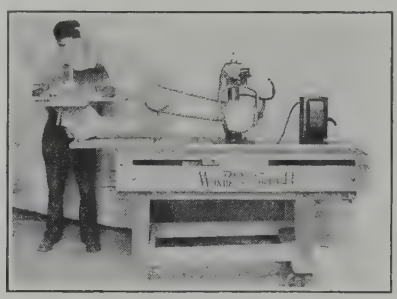
The 36-in. I-beams are rolled in weights of 147, 155, 164 and 173 lb. per ft. and the girder beams are rolled in weights of 231, 240, 250 and 260 lb. per ft.

These new sections will have especially large application in railway and highway bridges and in building construction. They are rolled on the company's patented Grey mills and a regular rolling schedule is being maintained. The company announces that the sections are now available.

New DeWalt Portable Band Saw

The DeWalt Products Company of Leola, Pa., has recently announced a new portable band saw that is said to have an unusual capacity.

The DeWalt band saw is designed to provide in a portable machine power and handling capacity of a production stationary band saw. The machine is guarded to a maximum degree. The DeWalt band saw above the floor standard is mounted in one casting housing



New Band Saw Set Up for Use With DeWalt "Wonder-Worker" Saw Rig

the three tracking pulleys and saw blade. By the simple means of one cover hinged on to the casting the blade is entirely covered, is only open at the cutting point.

The unusual feature of using three tracking pulleys instead of two large pulleys to separate the two sections of a revolving saw blade has made it possible to design a compact machine with 20-in. clearance in the throat between saw blade and frame; with capacity to handle material up to 7 in. thickness.

The entire machine, including floor standard motor, weighs only 210 lb. Without motor and floor standard it weighs 120 lb. This portable advantage does not in any way handicap it as a stationary unit. It has the power and capacity of a production machine, say the manufacturers.

This unit is preferably used as an individual motor driven unit equipped with motor and floor standard. However, the DeWalt band saw can be used independent of motor and floor standard. This unit can be mounted on a DeWalt "Wonder-Worker" so as not to interfere with any other operation of that machine. By simply attaching the pulley on the arbor of the Wonder-Worker and swinging arm to the rear the band saw is ready to operate. Replace the V drive pulley of band saw with flat belt pulley and the DeWalt band saw can be driven from a line shaft.

Twelve outstanding principals incorporated in the design of the DeWalt Band Saw are:

Twenty-inch throat clearance; compact roller saw guide, adjustable to handle material 7 in. thick; three aluminum ball bearing mounted pulleys; completely covered saw track and pulleys, with only 8 in. of saw surface exposed and that only at the cutting point; working table 13⅝ in. square; dial indicator in degrees measures the work, table tilts 45 deg. to the right and 30 deg. to the left; table stop to quickly bring table to exact horizontal position; tracking device to adjust rollers so that saw tracks are exactly over rollers; silent transmission of power by V belt to motor, pulley drive to line shaft or direct driven from DeWalt "Wonder-Worker" motor shaft; ½ hp. motor to suit proper requirements; floor standard is light in weight, rigid construction, with sheet metal base, solid and permanent; weights are as follows:

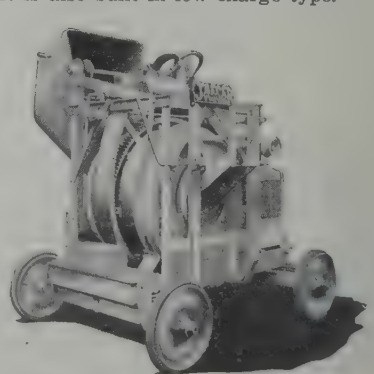
Individual motor-driven band saw complete with motor and floor stand	210 lb.
DeWalt band saw attachment	120 lb.
Floor standards	55 lb.
Motor	35 lb.

Jaeger Announces New Mixer

The "Speed Queen," a 7-S non-tilt concrete mixer, on four wheels and with a spring hung chassis, is the latest announcement of The Jaeger Machine Company, Columbus, Ohio. Its mixing time and time for charging and discharge are the same as the Speed King, a fast one bag trailer introduced by the Jaeger company a year ago.

Longer life to the mixer and saving of wear on tires, due to the new spring mounted construction, are claimed by the maker. Being built of steel the Speed Queen also combines an estimated 50 per cent extra strength with a saving of one-half ton in weight, according to the manufacturer. Rollers and countershaft are ball bearing; the steel disc wheels are roller bearing.

Price of the standard model, which is stated to be a considerable reduction under the present market, includes Automatic Skip Shaker, Accurate Measure Water Tank, 2 cyl. Le Roi engine. It is also built in low charge type.



The Speed Queen, a New Mixer Announced by Jaeger

Time Saving Methods in Billing and Collecting

Methods Developed by a Canadian Town

By W. D. STALKER

Secretary, Simcoe Public Utilities Commission, Simcoe, Ont.

THE Town of Simcoe has had the same rapid electrical growth as like Hydro municipalities in Ontario, but while substation and line had been extended and rebuilt, for ten years the office had stood still. It was thought, therefore, that the office would soon have to be enlarged and the staff increased. However, just as the regulation of loads may improve distribution conditions to such a degree as to save the installation of additional station capacity, so too in the office the correction of "office power factor" may save the employment of more "prime movers." This was tried in the office of the Simcoe Public Utilities Commission with rather remarkable results.

Office Plan.—Advantage was first taken of a general change in the municipal building to so design the billing and collecting office that the best layout for local conditions might be obtained. During the alterations a temporary arrangement for collecting proved so convenient for posting also, that the idea suggested itself of embodying the posting desks with the counter inside the wickets. The final result has not only saved steps and time for the office staff but also the public is more quickly served.

Addressograph.—It had been standard practice to make out and address all hydro and water bills by hand, using a postcard type of bill. An addressograph and graphotype were now added to the equipment and a great time saving in addressing was made immediately. Parenthetically, it may be remarked, that while at first somewhat dubious about the wisdom of purchasing a graphotype, this machine saved a considerable part of its cost by enabling the local staff to make all the originally necessary plates or stencils, as occasion presented, at small cost, and is now invaluable for changeover and new services.

Straight Line Bill.—The full advantage of the addressograph equipment was not realized, however, until the old card supply was exhausted and use of the "straight line" bills was commenced. For both electricity and water, these were designed by the Hydro Electric Power Commission Municipal Auditor, Mr. McCollum. The only continued criticism made of this straight line bill, has been by a school teacher, who objected to the number of times the word "bill" appeared. The answer is, howere, that the reiteration automatically draws the bill-fold from the customer's pocket and painlessly extracts the required number of bills to pay the bill before the discount date.

Computer.—The use of a Bates Index, with ribbon for computing domestic electricity bills without figuring them, has also proved a valuable timesaver. The bills are first run through the addressograph which puts the complete address including service number, on both bill and stub at one operation. They are then typed directly from meter sheets, the amount of the bill being read off the index or computer, and the lay-out of the bill is such that all typewritten figures are in one straight line, so that no extra setting of the typewriter roller is necessary. The meter reading and amount of the bill is entered on the ledger card by hand at the same time. By taking the readings form the meter books the bills are kept in the correct rotation for subsequent delivery, saving time formerly spent sorting. The addressograph plates are of course kept in their trays in the same order as the meters are read, so that proper plates feed into addressograph automatically.

Off-Peak Time.—The address of all bills and also the dating with a rubber stamp is done ahead of time in "office-off peak" hours. This has helped flatten the monthly office load curve, and there is but a small "valley" between billing periods. Even this "depression" may be overcome by having the last discount date for electricity bills the 10th of the month and giving until the 15th for water accounts. This "staggering" has just been inaugurated, and so definite results have not yet been obtained.

Side-Opening Meter Books. — Not content with the foregoing changes, side-opening meter books were also recommended. They were accordingly purchased and have not only been approved by the meter man but have been endorsed by the office staff. The office saving is particularly noticeable in billing the domestic hydro accounts when meter books, cards, computer and typewriter are all used together.

Meter Department.—Due to the small size of the system it had previously been the custom to use a lineman for the necessary time each month reading hydro meters, and a man from the waterworks department to make their quarterly water reading. This has now been combined under one meterman, who reads all meters both electric and water, and if time permits, delivers the accounts. This arrangement has not only effected a saving in cost but is more satisfactory to all the departments. The outside electric work is not interrupted, the water work is not inconvenienced, and the office is in closer

SIMCOE PUBLIC UTILITIES COMMISSION
58 PEEL STREET, SIMCOE, ONT.

THIS BILL IS DUE WHEN RENDERED. Unpaid Bills will be Collected According to Public Utilities Act

Date	Present Reading	Previous Reading	Consumpt'n	Consumpt'n Charge	Service Charge	Gross	Net
					Arrears		
					Total		

This Bill is for **Two** Months From Meter Reading Date on Previous Bill, Unless Stated Otherwise Here.....Months
Installed Capacity.....Watts.

THIS BILL SUBJECT TO METER OR CLERICAL ERRORS.

Payable at Clerk's Office
58 Peel Street
Office hours:
9-12 a.m., 1-5 p.m.

For details of billing see back of bill.

SIMCOE PUBLIC UTILITIES COMMISSION
HYDRO LIGHTING SERVICE
Mail stub only when paying by cheque.
If receipt is desired, enclose postage for return

Gross	Net

Account

Last Discount Day
10th

Straight Line Bill Used for Lighting Service

SIMCOE PUBLIC UTILITIES COMMISSION
WATERWORKS DEPARTMENT

THIS BILL IS DUE WHEN RENDERED Unpaid bills will be Collected According to Public Utilities Act

Date	Present Reading	Previous Reading	Consumpt'n	Consumpt'n Charge	Meter or Flat Rate per Quarter in Advance	Gross	Net
						Arrears	
						Total	

This Bill is for **Three** Months from Meter Reading Date on Previous Bill, unless stated otherwise here.....Months

The consumption charge is 15 cents per 100 cu. ft.

The By-law provides that if this Account is not paid within 15 days after the date rendered, water shall be turned off until arrears and charges are paid, including an additional charge of 50 cents for turning off and on

SIMCOE PUBLIC UTILITIES COMMISSION
WATERWORKS DEPARTMENT
Mail stub only when paying by cheque.
If receipt is desired, enclose postage for return

Gross	Net

Account

Last Discount Date
15th

Straight Line Bill Used for Water Service

touch at all times with the meter department. On some routes both electric and water meters are read at the same time which has not only resulted in a time saving but has proved more satisfactory to the customers who are thus subjected to fewer calls and less change in personnel.

Results.—As these changes have taken place successively the credit due each factor has been noted and the results tabulated:

Electric—

Billing periods

Old System	54	hrs.
New System	29	"
Saving	25	"

Allotment of Saving

Office Plan	7½	hrs.
Addressograph	12	"
Straight line bill	½	"
Computers	3	"
Side-opening Meter books	½	"
	25	"

Waterworks—

Billing Periods

Old System	126	hrs.
New System	54	"
Saving	72	"

Allotment of Saving

*Office Plan	38	hrs.
Addressograph	31	"
Straight line bill	3	"
	72	"

*The large saving allotted to office plan is by reason of a more convenient arrangement of the waterworks ledgers, three ledgers being used simultaneously.

Absit Omen.—Astonishing as results have been, a continued study with a view to further time saving reveals that the limit has even yet not been reached. A better wicket lay-out, a further use of computing charts, and the installation of power driven equipment will eventually, be necessary as the increase in the municipality again loads the office to 100 per cent capacity.

Tools Needed for Sewer Maintenance

By C. V. JOYCE

In view of the great investment in sewerage systems it is only proper that a sufficient amount of money should be expended to care for these structures, keep them clean, in repair, and ready to serve their purpose at all times. When a sewer fails to perform properly there is likely to be serious complaint and severe criticism of those responsible for its operation. It costs less to make minor repairs as they become necessary than to allow them to await a more convenient time for repair. Serious damage may often be avoided if inspections are frequent and the minor repairs made promptly.

A knowledge of the general physical condition of the sewers is necessary for their proper operation. This can be had best from regular and systematic flushing and inspection. The small sewers at the upper ends of a system, and especially those having exceptionally flat grades, should be flushed and inspected once a month, or even more frequently where required by local conditions. Siphons and those sewers which accumulate large amounts of detritus should be inspected monthly. A general inspection of the entire system should be made annually along with the regular inspection of the smaller sewers. In making an inspection, defects in masonry of the manholes, breaks, stoppages and any unusual deposits in the lines should be noted. Mirrors may be used to reflect a pencil of light through the pipe between manholes. If artificial light is needed electric lamps should be used in preference to candles or kerosene lanterns in order to avoid the danger from gas explosions.

Stoppages in sewers are caused by heavy deposits, such as sand, gravel, or road detritus; lighter deposits of organic matter, grease, roots, rags, breaks in the sewer, and miscellaneous materials. Heavy deposits may be removed with a scoop or collapsible hoe attached to sewer rods, a self-propelling nozzle attached to fire hose, or by the use of a power or hand operated sewer cleaning machine with sewer buckets.

Roots find their way into sewers through defective joints, cracks and sometimes through a hole as small as that in a darning needle. Once entered they grow, branch out, and thrive. If not removed they become matted hair-like beards 2 or 3 ft. and some times 8 to 10 ft. in length. Roots are best removed by the use of a sewer cleaning machine with root cutting buckets. Two buckets suited to the size of sewer are drawn into it, one with the cutting edge down and the other with the cutting edge up. In this manner the full circumference of the pipe is rubbed with the knife edge of the buckets so that the roots are cut wherever they enter. A crew consisting of a foreman and 4 laborers operates the cleaning machine. A windlass is set up over each of two manholes. Rods, 3½ ft. in length, are pushed through the line and wire rope from one windlass is drawn through as the rods are taken from the next manhole. A cable end from each windlass is then attached to the buckets. The buckets are drawn into the sewer until they become loaded with roots and then are pulled back to be emptied. This is repeated until the buckets have passed to the next manhole. Roots soon grow back into a sewer. When they become abundant and very troublesome it is more economical to uncover the joints affected and replace them with a root resisting compound.

The following tools and equipment are essential for the operation and maintenance of the sewerage systems in small cities. A sewer cleaning machine consisting of two windlasses and a wagon frame on which to transport the windlasses should be provided. Each windlass should have about 500 ft. of 7/16-in. wire rope or an amount equivalent to the distance between manholes. One and one-quarter inch octagon hickory rods are essential. If they are 3½ ft. in length they will be found most convenient to use. Floating rods of the same size and shape, but of lighter wood, are advantageous in many instances. One inch round rods with Felton patented couplings are best for house services.

Cleaning tools used with the rods are a flat steel gouge, 4 in. wide for ordinary stoppages caused by small clumps of roots, rags, etc.; scoops, 18 in. long, made of sheet iron for small deposits of sand and gravel or mud; circular cutting tools for roots; a collapsible hoe and a claw for rags or paper. These tools are made slightly smaller than the pipe and are useful in house services. The collapsible hoe collapses when pushed ahead of the rods and opens when the rods are pulled back. It is useful in removing sand, gravel, and road detritus. Plain and toothed root cutting buckets of various sizes are used with the cleaning machine to remove deposits and roots.

A very useful tool for removing deposits of mud, sand, or gravel from sewers, and particularly from storm drains, is the self-propelling nozzle. Attached to a fire hose, it revolves, opens its way into the sand and mud and washes the deposits back down the pipe.

The elevations of manhole covers on unimproved streets must be changed to conform to new grades as the streets are improved. In this connection manholes built in the shape of a bottle neck are advantageous, as this allows the flange of the frame and cover to have a full bearing when the manholes are cut down or raised. When it is necessary to lower the cover on a manhole without the neck, the masonry must be taken out well below the new grade and the upper part of the manhole rebuilt to obtain sufficient bearing for the cover.

Acknowledgment.—From a discussion following a paper by another writer at the Second Annual Conference of the Maryland Water and Sewage Association.

New Traffic Ordinance of San Francisco Working Well.—The new traffic ordinance of San Francisco which became effective Nov. 1, 1927, is stated to be bringing excellent results. Figures show a notable reduction in the number of personal injuries and in the amount of property damage. It is estimated that a saving of $2,000,000 a year in the cost of automobile accidents is being made for the vehicle owners of San Francisco. The new ordinance is stated to have materially increased the average speed of traffic by eliminating unnecessary delays at clearance zones near intersections and by providing loading zones to eliminate double parking, by means of signal systems, and other improvements.

Court Decisions Relating to Sanitary Matters

Rulings Summarized in Public Health Report

Disposal of Garbage by City Held Governmental Function. — (Michigan Supreme Court; Curry v. City of Highland Park, et al., 219 N. W. 745; decided June 4, 1928.) In a suit for specific performance involving the sale of certain land, owned by the city of Highland Park and used principally for the disposal of the garbage of the city, the question was presented as to whether the said property was used in the discharge of a governmental function. The supreme court held that the disposal of garbage by the city was a governmental function, saying:

* * * The matter of public health is not local; it concerns the State. In matters relating to public health, the city acts as an arm of the State, and the property whose use is devoted to the public health is used in the discharge of a governmental function. * * *—Public Health Reports, Aug. 3, 1928.

City Held Liable for Water-borne Typhoid Fever.—(New York Supreme Court, Appellate Division; Wiesner v. City of Albany, 229 N. Y. S. 622; decided June 22, 1928.) An action was brought against the city of Albany to recover damages for illness caused by typhoid fever. It was claimed that the disease had its inception in unwholesome water furnished by the city, that this condition arose through the negligence of those in charge of the water system in failing to purify the water delivered to consumers, and that the authorities neglected to give warning although they had notice that dangers existed. The city water supply was taken from the Hudson River, and to purify the supply the city had a system of filtration and chlorination. After chlorination the water went into a "pure water" or "clear water" well, and from there was conducted through a conduit 8,000 ft. long to a pumping station whence it was distributed through the city mains. The conduit for the greater part of its distance was under the bed of the old Erie Canal. The walls of the conduit had become rusted and broken, so that there were holes therein, of which the city had notice and which permitted external waters to seep into the conduit. There was evidence that the waters remaining in the canal basin were polluted. On nearly every day between April 7 and 23, 1924, colon bacilli were found in increasing numbers in the city water supply, indicating some definite source of pollution not eliminated by filtration, but the city took no preventive measures until an epidemic had broken out. A jury returned a verdict for the plaintiff and the judgment thereon was affirmed by the appellate division of the supreme court. The following are excerpts from the appellate division's opinion:

* * * The officials in charge of the water department had notice of the defective condition of the conduit, the sudden pollution of the water, and of the outbreak of diseases traceable to impure water, but the warnings were ignored. It was a time for prompt and decisive action. There were two possible sources of contamination—one by impure water passing the filters into the well; the other by introduction of polluted water into the conduit. The exercise of vigilance would have led to discovery of the dangerous condition and reasonable diligence would have provided the remedy. It was possible, by greater chlorination before the water went into the clear-water well, to eliminate all dangerous bacilli which had passed the filter, and there was a chlorination plant at the Quackenbush Street pumping station which would have removed the new pollution occurring in the conduit, but this was not put in use, at least during the first 10 days in April. Common prudence would have suggested a notice to citizens that the water had become polluted, and a recommendation that all water intended for human consumption should be boiled. But no preventive measures were taken until an epidemic had broken out.

* * * * * * *

* * * The evidence supports and justifies the verdict that those performing duties so closely related to the public health were negligent in failing to exercise reasonable and commensurate care in providing wholesome water. * * *—Public Health Reports, Aug. 10, 1928.

City Held Liable for Nuisance Caused by Septic Tank.—(Kansas City, Mo., Court of Appeals; Newman v. City of Marceline, 6 S. W. (2d) 659; decided May 21, 1928.) An action was brought against the city of Marceline to recover damages for the maintenance of a nuisance. The plaintiff alleged that a septic tank, constructed and maintained by the city near her residence, which she owned, emitted foul and offensive odors which deprived her of the comfort and enjoyment of her home. The city's contention was that, if the septic tank was a nuisance, it was a public one, and, for that reason, it was incumbent on the plaintiff both to allege and to prove that she sustained special injuires or damages different in kind or character from those suffered by the public generally. In affirming a judgment for the plaintiff, the court of appeals said:

While the petition does not specifically allege that the injuries suffered by plaintiff were different in kind or character from those suffered by the public generally, it does allege that the septic tank, filled with sewage from defendant city, was maintained near her residence, and that foul, dangerous, and offensive odors came from said sewage onto plaintiff's premises and into her dwelling house, and deprived her of the comfort and enjoyment of her home, rendered same unsalable, and caused her to lose the reasonable rental value thereof. It may be true that the stench from the septic tank affected alike all who came in contact with it, but the fact that plaintiff owned and lived in property located near the tank, and was disturbed in the comfort and enjoyment of her home, by reason of the foul and offensive odors coming from the sewage in said tank, entitled her to maintain an action for said injuries. This tank was peculiarly injurious to plaintiff on account of its close proximity to her home. This being true, a petition alleging such facts states a cause of action, although it may not specifically allege that the injuries sustained by plaintiff were different in kind from those suffered by the public generally. * * *—Public Health Reports, Aug. 10, 1928.

Private Law Creating Special Sanitary and Maintenance District in Certain County Held Void and General Act Authorizing Creation of Sanitary Districts Held Constitutional.—(North Carolina Supreme Court; Drysdale, et al. v. Prudden, et al., 143 S. E. 530; decided June 6, 1928.) In this case, a controversy without action under section 626 of the Consolidated Statutes, the plaintiffs constituted the board of Druid Hills sanitary district and the defendants were engaged in the business of investment banking. The said sanitary district was created pursuant to an act ratified March 4, 1927, constituting chapter 100 of the Public Laws of 1927. At an election upon the question of the issuance of bonds by the district the vote was unanimous for the issuance of same. The plaintiffs took proceedings for the issuance of the bonds of the sanitary district in the aggregate principal amount of $75,000 for the purpose of acquiring, constructing, maintaining, and operating a sewerage system and water-supply system, and entered into a contract with the defendants whereby the latter agreed to purchase said bonds. The contract stipulated, however, that the defendants should not be obligated to take up and pay for the bonds unless they constituted the full and valid obligation of the sanitary district and were payable from an unlimited ad valorem tax upon all taxable property of the district and not from special assessments. The defendants refused to accept delivery of the bonds, but the agreed statements of facts in the case contained the provision that "if the plaintiffs are authorized to issue them and they will constitute the full and valid obligations of Druid Hills sanitary district, payable from an unlimited ad valorem tax upon all taxable property of said district, and not from special assessments, then the defendants stand ready, willing, and able to take up and pay for the same in accordance with their contract."

The identical territory comprising the said sanitary district was created or attempted to be created into a sanitary and maintenance district by a special act ratified March 7, 1927, constituting chapter 229 of the Private Laws of 1927. The State constitution, article 2, section 29, provided:

The general assembly shall not pass any local, private, or special act or resolution * * * relating to health, sanitation, and the abatement of nuisances; * * * Any local, private, or special act or resolution passed in violation of the provisions of this section shall be void. * * *

The supreme court stated that

practically only two material questions were presented, namely:

Was chapter 229 of the Private Laws of 1927 a local, private, or special act, in violation of section 29 of article 2 of the State constitution, and therefore void?

Was chapter 100 of the Public Laws of 1927 constitutional and the bonds valid?

The court held that chapter 229 of the Private Laws was void and that chapter 100 of the Public Laws was constitutional, and closed its opinion with the following language:

The act (chapter 100) is sane, sound, and sensible—well within the police power of the State to pass. Therefore, we think that chapter 100 of the Public Laws of 1927 is constitutional, and that the proposed bonds under said act are valid and binding obligations of the Druid Hills sanitary district, and are payable from an ad valorem tax against all the taxable property within the boundaries of said district, and that the judgment of the court below should be affirmed.—Public Health Reports, Aug. 24, 1928.

City Held Liable in Damages for Sewage Pollution of Stream.—(Indiana Appellate Court; City of Frankfort v. Slipher, 162 N. E. 241; decided June 19, 1928.) The appellee owned a farm through which a natural watercourse flowed. In an action by him for damages against the city of Frankfort, it was alleged that the city had polluted the watercourse by unlawful deposit of sewage therein. The trial court found the following facts specially: That the city emptied its sewage into the watercourse; that such sewage was dangerous to public health, and had made the occupying of the dwelling houses on the appellee's land uncomfortable and unsatisfactory, and interfered with the use of his land; that the city could, at a reasonable cost, have erected a sewage-reduction plant, so that all of the sewage could have been rendered pure and harmless; that the city negligently failed to take any steps to erect a sewage-reduction plant or to reduce the unwholesome and dangerous condition of the sewage; and that the city negligently deposited the sewage in the watercourse to the injury of the appellee. The court concluded as a matter of law that the appellee should recover damages and entered judgment in accordance therewith. The appellate court affirmed such judgment saying:

Under the facts as found by the court, public necessity did not call for or require the pollution of the water of either Prairie Creek or South Fork, and, since appellant, by the expenditure of a reasonable sum of money, could have adopted a method of purifying the sewage, the judgment should be affirmed.—Public Health Reports, Aug. 31, 1928.

Joint Conventions by Municipal Organizations at Cincinnati

The National Municipal League, the Governmental Research Association and the National Association of Civic Secretaries will hold their 1928 Conventions jointly in Cincinnati, Oct. 15, 16, and 17 with headquarters at the Hotel Sinton. The Governmental Research Association and the National Association of Civic Secretaries meet alone on Oct. 15; on Oct. 16 and 17 the three organizations meet together.

Murray Seasongood, Mayor of Cincinnati will officially welcome the members of the Governmental Research Association, at a noon meeting Oct. 15. The leading feature of the morning's program will be an address by John B. Blandford, Jr., Director, Cincinnati Bureau of Municipal Research on "A Fact Basis for Community Action." During the afternoon simultaneous round table sessions will be held, as follows: Special Assessments, Philip H. Cornick presiding; Financial Statistics of Cities, C. E. Rightor, presiding. A feature of the round table on Financial Statistics of Cities will be an address by Starke M. Grogan, Chief Statistician United States Bureau of the Census, on "Compiling Financial Statistics of Cities."

"Methods of Securing Support for a Civic Project," with a discussion led by Nat Spencer, Secretary, Citizen's League, Kansas City, Mo., will be a feature of the dinner meeting of the National Association of Civic Secretaries, Oct. 15.

"The City's Responsibility in Housing" will be the topic discussed at a general session on the afternoon of October 16. This meeting will be addressed by S. J. Herman, Executive Director, Michigan Housing Association, who will speak on "State or Regional Credits as a Practical Substitute for Municipal Recognition of Housing as a Public Utility." Addresses will also be given by John Ihlder, Housing Expert, Washington, D. C., and Bleecker Marquette, Executive Secretary, Public Health Federation, Cincinnati. At a dinner meeting that evening among the speakers will be Dr. Charles A. Beard, who will discuss "The City's Place in Civilization." Simultaneous round table sessions will be held during the morning of the 16th as follows: The Negro and Public Affairs, Alfred Bettmen, presiding. Addresses will be delivered by Robert T. Lansdale, Executive Secretary, The Council of Social Agencies of Montclair, N. J., and Ralph Johnson Bunche, Howard University, Washington, D. C. Measurement Standards in Government. Colonel H. M. Waite, presiding. A report will be given by Clarence Ridley, secretary, National Committee on Municipal Standards.

A comparison of certain municipal administrative practices in America and Great Britain by Arthur Collins, financial adviser to local authorities of England will be the leading feature of the luncheon meeting on Oct. 17. During the morning, round tables will be held as follows: Proportional Representation and Democracy in Elections, C. A. Dykstra presiding. An address will be given by Joseph P. Harris, University of Wisconsin, Selling the Work of Government to the Public, Stephen B. Story, City Manager, Rochester, N. Y., presiding. Addresses will be given by Wylie Kilpatrick, University of Virginia, Herman C. Beyle, Syracuse University, and Moses Strauss, editor, Cincinnati Times-Star.

General arrangements for the conventions are in charge of Russell Forbes, Secretary, National Municipal League, and local arrangements are being taken care of by John B. Blandford, Jr., Director, Cincinnati Bureau of Municipal Research.

Community Bath Houses with Fees Suggested

Gov. Fuller of Massachusetts spoke at the public hearing held by the Salisbury Beach and Duxbury Beach Reservations Commission in Cottage Owners' Association Hall at Salisbury Beach, Mass., on the bathing beach problem. Extracts from his speech, as given below show an interesting trend of thought.

"This commission will consider, I assume, some fairly definite unit plan applicable to our various beaches such as, for example, a community-owner bath house at each of our large beaches," he said. "These bath houses should be provided with facilities that would take care of, let us say, 1,000 people. There would be a superintendent in each. I assume that these facilities could be made practically self-supporting. A nominal charge would be made for the use of a bathing suit and the facilities of the bath house. This bath house would be constructed by the county or by a group of cities within a reasonable radius of the beach.

"A group might be made up of Newburyport, Lawrence, Haverhill, Amesbury, Merrimac, and Salisbury. Those cities would form such a combination as that which we have in our Metropolitan District of Boston.

"To one who has traveled in the Middle West it is not difficult to realize that one of the priceless assets which we have in Massachusetts is our seashore washed by the waters of the Atlantic.

"It is an important problem you gentlemen are applying yourselves to and I wish you well and promise you my cooperation. If you want to start your first unit here in Salisbury Beach and you decide upon one plan where the State or county pays one-half the cost, leaving the rest perhaps for the local communities to raise, I would be very glad of the privilege of paying 50 per cent of the cost which would otherwise be assessed upon the various communities in order that this program might get under way at once."

Asphalt and Granite Block Pavement Methods in the City of Chicago

How Heavy Traffic and Light Traffic Pavements Are Laid on Assessment Jobs

OF the several types of paving used by the City of Chicago on the many streets of the various sections of the city, two well known types still used to a large extent are granite block and asphalt, both constructed on a 6 or 8-in. concrete base. The granite block is used on some through streets that carry a heavy street car and truck and wagon traffic, where traffic conditions are of the most severe type. Asphalt is used on boulevards and outlying residential streets. Both types are represented in this article.

Western Avenue.—This is a through north and south street terminating in a main state highway south of the city and affords access to the main highways to the north at Evanston, Ill. Western Ave., north of Belmont Ave., was paved with asphalt in 1927, the part south of Belmont Ave. and north of Fullerton Ave. has just been completed. This street was recently widened by condemnation from 66 ft. to 100 ft. Inside the city, the traffic is mixed and of the heaviest type. The old pavement has been torn up and the street is being widened to 27 ft. on each side of the double track line of the surface lines in the center of the street, making a total roadway width of 70 ft. The pavement is a granite block surface on a 1½ in. sand-cement cushion 1:4 mix, resting on an 8 in. concrete base. The base mix is a 1:3:6 concrete. No reinforcing is

Granite Block Paving on Western Avenue, Chicago
1—Laying Block; 2—Closeup of Laying Block Under Watchful Eye of Inspector; 3—This Mixer Furnished the Grout; 4—View of Completed Work; 5—View of a Difficult 3-Way Intersection. Traffic Lights Synchronized for 3-Way Interval Control the Traffic with One Street Moving and Two Standing.

used, and no provision is made for expansion in the base. The section of the base is curved upward toward the center to afford the desired crown. Concrete curbs 9 in. by 21 in. deep are built prior to laying the base. The base is laid with the usual organization, as later described. The sand in the sand-cement cushion is of ordinary torpedo sand of the same grading as is used in the grout to fill the spaces between the block.

Laying the Block.—About 80 per cent of the old 5 in. granite blocks were relaid, adjacent to the curb. The new granite block are delivered by motor truck to the subgrade and piled so as to minimize rehandling to the layer. Two layers then work side by side at convenient intervals, laying the block in place on the sand-cement cushion ready for the grouting. The work of each pair is divided by a line staked down the center of the 27 ft. strip in order that each man will have a uniform width to lay and in order that each man's work can be easily observed by the foreman. From 10 to 24 layers are on the job on any one day, with an average of about 18, and one helper is employed for each layer. A good man averages about 40 sq. yd. per 8 hour day. Felt expansion joints are placed across the granite pavement at intervals of 30 ft.

Grouting.—The 1:1 cement and sand grout is mixed in a 1 bagger Kwik-Mix tilting mixer on a nearby intersection, with the sand and cement piled alongside on the pavement, and with water obtained from the nearest fire hydrant. Two men operate this mixer.

Two wheelers with concrete buggies transport the grout to the point of pouring and the grout is poured and broomed over the pavement until joints are almost filled. Blocks and sand are handled in wheelbarrows.

This pavement was being laid for the Board of Local Improvements by the Ready Coal and Construction Co., Chicago, represented on the work by Lawrence Ready, supt., while the city was represented by J. J. Norton, inspector.

A Large Asphalt Job.—Between Oak Park Avenue, Harlem Avenue, Armitage Avenue and North Avenue, the city is paving the complete street system with asphalt, totaling about 87,000 sq. yd. separated into two contracts. These residential streets are to consist of a 6 in. concrete base, 2 in. of binder, and 1½ in. of top, laid into pavements of normal residential width. Curbs and gutters are of the combination type, of concrete construction. Elevating graders and dump wagons were used on the subgrade work.

Materials for Base.—Stone and sand for the base concrete were delivered to a nearby pavement by motor truck from the material yard and dumped along the curb. Sacked cement was delivered by trailer and the trailer spotted between the sand and stone so that the cement could be unloaded direct into the batch trucks. Barber Greene loaders, one for sand and one for stone,

1—Cement and Aggregate for Base, Loaded into Batch Trucks Here; 2—Paver Used in Laying the Base; 3—Dumping and Spreading the Binder; 4—Rolling the Binder; 5—View of Finished Asphalt Pavement

Asphalt Paving in New Residential Area

were used to take the aggregates from these stock piles and load into the batch trucks. Five men were used on the cement, and a loader operator with one laborer were used on the sand and one operator and two laborers were used on the stone. A fleet of 8 Hug trucks with single batch Anthony dump bodies were used to deliver the dry batches from the stock piles to the paver.

The Paver.—A Rex 27-E paver was used to mix the concrete for the base. This paver was manned by one operator, one helper, one man on the subgrade, one dumper, three grade men, four puddlers, two broom men, and one tamper. With this organization, and a minute mix, the contractor was able to lay 1,900 sq. yd. of base per 8 hour shift.

The Asphalt Gang.—As soon as the base had cured sufficiently, the binder course was then laid. Using 18 trucks and a haul of about 9 miles from the asphalt plant, and with 25 men on the grade, and three rollers, the contractor could average 3,000 sq. yd. of finished pavement per 9½ hour day, with the rollers working 12 hours. Binder was laid in the afternoon and top in the following morning. One man was employed sprinkling cement on the rolled top with a broom and another man was used to paint the gutters. The roller equipment used was a 15-ton Iroquois roller, a 10-ton Erie, and an 8-ton Iroquois. With this equipment, the both courses were rolled until accepted by the inspector.

On this work, done by the White Construction Company, the contractor was represented on the base work by C. H. Watson, foreman, and on the asphalt work by Wm. T. McCarthy, foreman. The Board of Local Improvements was represented on the base work by Don Barry, inspector, and on the asphalt by T. F. Turner, inspector.

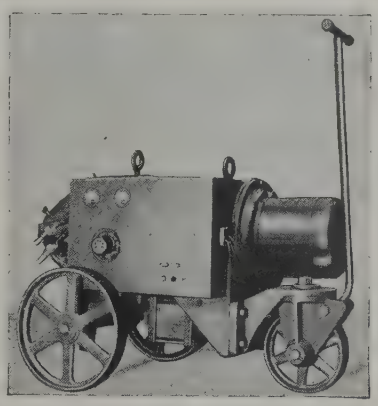
The planning and supervision of the work in general was done for the City of Chicago, by the Board of Local Improvements, of which M. J. Faherty is president, while the work was done under the general direction of Hugh J. Fixmer, division engineer.

Westinghouse Announces New Arc-Welder

A new Westinghouse, 200 ampere, single-operator welding set has been designed to meet every requirement in both the shop and field, and to serve all applications within its rating, with speed and economy, according to the manufacturers. This new unit is outstanding in its features of simplicity of operation and compactness in construction.

The set is started by connecting directly across the line by means of a Linestarter and Linestart motor. Starting and stopping are accomplished by the simple operation of a push botton. A single rheostat varies the arc current over the entire welding range. Accurate adjustment over the welding range, from 60 amperes to 300 amperes, is afforded by steps of 5 amperes.

The motor-generator, and control equipment are assembled in a totally enclosed frame. The exciter, which is overhung from the motor end, is securely fastened to the unit frame. This type of construction guards the operator against injury, and protects the set from dirt and falling objects. In performance tests welding operations have been carried on while the sets were suspended at every angle that could possibly be required in any application. Operation is as satisfactory when the set is placed on end, as



New 200-Ampere Arc-Welder

when it is in the normal position, it is claimed.

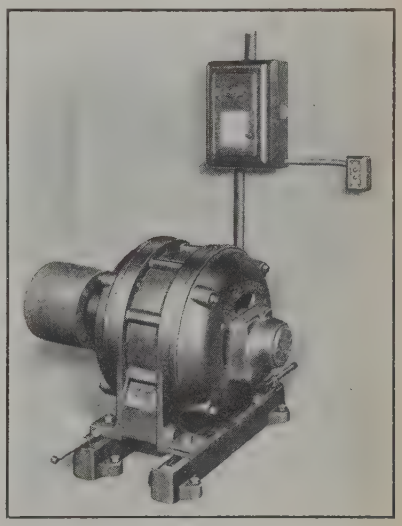
Steady welding current, insuring thorough penetration and fusion of the weld, is obtained from a constant current generator. A separate exciter is used in all Westinghouse single-operator welders. It insures a high speed of welding, and a machine whose generator voltage responds to any changes in arc conditions this tending to maintain a constant rate of fusion of the electrode.

The unit is rated at 200 amperes, 1 hour, 50 deg. rise on a resistance load at 25 volts which conforms to the standard rating of the National Electrical Manufacturers Association. The motor is wound for 220 or 440 volts and is assembled with the necessary connections made for operation from a 3-phase 60-cycle circuit. If it is desired to operate the unit from a 440 volt, 3-phase, 60-cycle circuit, it is only necessary to replace the operating coil on the magnetic starter, and to reconnect the motor leads.

Toledo May Have City Manager.—The city of Toledo, O., will vote in November on the adoption of a new charter, the distinctive features of which provide for a city manager and for a council elected by proportional representation.

Line Start Induction Motors

A line of squirrel cage induction motors suitable for starting on full line voltage is being placed on the market by Allis-Chalmers Manufacturing Company. These motors are normal torque, high reactance machines and will not draw starting current in excess of the limits recommended by the Electrical Apparatus Committee of the National Electric Light Association. They are built in ratings 7½ to 30 h.p., 600 to 3,600 r.p.m., low voltage, and are available with either sleeve or roller bearings. All features of Allis-



New Line Start Induction Motor of Type Recently Introduced by Allis-Chalmers

Chalmers construction as employed in squirrel cage motors are maintained in this new line. A magnetic switch with push button control is the only starting equipment required.

New Device for Protecting Pedestrians.—A new device for the protection of pedestrians has been placed in service by the city of Los Angeles, Cal. It is intended as a signal for approaching street cars as well as to safeguard pedestrians boarding the trolley. As the street car nears, the pedestrian pushes a button on the post and the signal flashes a red light, halting vehicles and flooding the approach to the track and the loading zone with a brilliant light.

Sixty-eight Administrative Areas in One County.—According to the recently published report of Harland Bartholomew and Associates on county planning for Lucas County, O., that county has 13 townships, 8 sanitary districts, 17 school districts, 9 incorporated cities and villages, and 21 unincorporated towns and minor civil divisions—a total of 68 administrative areas in the county.

International Association of Sanitation Officials

9th Annual Conference to Be Held Oct. 8 and 9 at Toronto, Ont.

THE leading city officials of the United States and Canada engaged in street sanitation work will meet at Toronto, Ont., on Oct. 8 and 9. This meeting, the 9th annual conference of the International Association of Street Sanitation Officials, promises to be the best ever held by the association. The headquarters of the conference will be King Edwards Hotel, Toronto. The program and entertainment which the association officials have planned in co-operation with representatives of the host city, Toronto, are believed to outclass any yet offered. Every minute promises instructive talks and discussions or unusual recreation which no city official will regret having had a part in. The whole gamut of problems which daily or weekly confront street officials will come in for attention and many a worthwhile idea will be passed along by men with long experience.

One of the features of the conference will be a talk on "Disposal of Garbage by the Fermentation Process." This will be given by A. Boniface, Village Engineer of Scarsdale, N. Y., which has adopted an Italian plan to American conditions. Out in St. Louis, Mo., they have given much thought to parking and the results of efforts to solve the problem will be told by Robert B. Brooks, Superintendent of Streets and Sewers, in a paper, "Municipal Parking Grounds as a Means of Helping the Street Cleaning Problem."

Knowing what departmental employees are really doing, the streets they are covering and the kind of service they are giving is information that many city officials in charge of garbage and refuse removal like to have. Mr. Samuel A. Greeley, Consulting Engineer of Chicago, Ill., has had quite a bit of experience in keeping records of this kind. He is to tell of his experience and give ideas to others during the course of a talk on "Routine Records of Collection Service."

Littering of city streets with the advertising matter of merchants and others causes many a worry for officials charged with keeping thoroughfares looking well. Antagonism of merchant-taxpayers is not always wise, yet appearance must be kept up. C. O. Davis, Superintendent of Street Sanitation in Milwaukee, Wis., has some ideas on this problem and will tell about them in a talk on "Advertising Matter Distributed or Posted on City Streets."

The chap who calls from his store or office as well as the housewife who hits the ceiling because garbage was not taken or a bunch of refuse was left in front of the premises will not be overlooked at the Conference either. The standing which an administration has in a community often depends much on the kind of service the city departments give. In Syracuse, N. Y., they take great pains to do things right and they have worked out a system for handling complaints which has had remarkable results. Morris S. Jones, Deputy Commissioner of Public Works of Syracuse, is going to tell how they do it in a talk on "Handling Complaints."

Maintenance of pavements after they are once laid and accepted is another big problem for city officials. The steady increase in traffic has given pavements much harder usage than in days past and much deep thought has been given to ways and means of getting funds to keep the roadways in satisfactory shape. There are some indications that a system similar to the gasoline tax plan must be adopted so that he who rides must pay. C. A. Hillegas, Superintendent, Department of Highways and Sewers, Pittsburgh, Pa., is one of many who face the question: What to do? He will give his views in a talk on "A Vehicle Tax for the Maintenance of Pavements."

Who Should Be Who?—Sometimes things do not run as smoothly as they might around City Hall because there is a division or over-lapping of authority. Team-work helps and they have found it to be so in Detroit, Mich. Captain Harrington Place, Engineer, Detroit Bureau of Governmental Research, will discuss the difficulties which can be adjusted and overcome in a talk on "Duties and Powers That Should Be Delegated to the Street Sanitation Official."

The talks mentioned above are but a few of those which are scheduled to be given at Toronto, as will be noted from the program which is printed in full below:

Program 9th Conference of International Association of Street Sanitation Officials
Monday, Oct. 8th

9:00 A. M.—Board of Governors Meeting.
9.00 A. M.—Registration, Mezzanine Floor, King Edward Hotel.
10:30 A. M.—Opening Session of 9th Conference, Pompeian Room, Mezzanine Floor, King Edward Hotel.
Address of Welcome.
Response.
President's Message.
Report of Board of Governors, Treasurer and Secretary.
Discussion of Subjects.
12:30 P. M.—Lunch, Pompeian Room, King Edward Hotel.
1:30 P. M.—Continue business session, Pompeian Room, King Edward Hotel.
7:00 P. M.—Dinner and entertainment, Pompeian Room, King Edward Hotel.

Tuesday, Oct. 9th

9:30 A. M.—Continue business session, Pompeian Room, King Edward Hotel.
1:15 P. M.—Leave Victoria Street entrance of King Edward Hotel for Lunch at Palais Royale, from there continue on inspection trip as guests of the City of Toronto.

1—Disposal of Garbage by the Fermentation Process—Mr. A. Boniface, Village Engineer, Scarsdale, New York.

2—Preventive Street Cleaning—Every Citizen a Member of the Street Cleaning Department—To be presented by a Member of The American City staff.

3—Importance of Street Cleaning—From the Viewpoint of a Physician, Who is Also a City Official—Dr. M. B. Herlong, City Commissioner, Jacksonville, Florida.

4—The Budget as It Might be Applied to Street Sanitation Activities—Mr. Elmer C. Goodwin, Examining Engineer, Department of Street Cleaning, New York City.

5—Snow Removal—Three-minute talks by officials from the snow belt.

6—Municipal Parking Grounds as a Means of Helping the Street Cleaning Problem—Mr. Robert B. Brooks, Director, Dept. of Streets and Sewers, St. Louis, Missouri.

7—Is It Desirable to Have Street Cleaning Activities Organized as a Bureau or Division of Some Department—If So, Into Which Department Does Such Supervision Naturally Fall?—Three-minute talks.

8—Routine Records of Collection Service—Mr. Samuel A. Greeley, Consulting Engineer, Chicago, Illinois.

9—Group Insurance for Municipal Employees—Mr. P. J. Hurtgen, Director of Public Works, Kenosha, Wisconsin.

10—Advertising Matter Distributed or Posted on Streets—Mr. C. O. Davis, Superintendent of Street Sanitation, Milwaukee, Wisconsin.

11—Handling Complaints — Mr. Morris S. Jones, Deputy Commissioner of Public Works, Syracuse, New York.

12—Vehicle Tax for the Maintenance of Pavements—Mr. C. A. Hillegas, Superintendent, Dept. of Highways and Sewers, Pittsburgh, Penna.

13—Duties and Powers That Should Be Delegated to the Street Sanitation Official—Captain Harrington Place, Engineer, Detroit Bureau of Governmental Research, Detroit, Mich.

14—Maintenance of Sewage Collection Systems—Mr. W. T. Knowlton, Sanitary Engineer, Los Angeles, California.

15—Street Maintenance—Mr. R. C. Harris, Commissioner of Works, Toronto, Canada.

16—Municipal Airports (Motion Pictures Showing Progress During Construction.)—Mr. Edwin A. Miller, Supervisor of Maintenance, Department of Public Works, Rochester, New York.

17—Rules and Regulations Governing the Use and Operation of Airports—Mr. Lester W. Herzog, Commissioner of Public Works, Albany, New York.

18—Alley Cleaning and Requirements of Property Owners in This Respect—Three-minute talks.

19—Public Convenience Stations, Their Construction and Control—Mr. W. C. Earle, City Engineer and Superintendent of Streets, Pasadena, California.

20—Benefits to Be Derived From the Use of Mechanical Devices in Street Sanitation Operation—Three-minute talks.

21—Methods Pursued to Prevent Promiscuous Dumping of Rubbish—Mr. W. J. Galligan, Assistant Superintendent, Bureau of Streets, Chicago, Illinois.

22—What Is Being Done to Streets on Which Are Located Abandoned Street Car Tracks?—Mr. L. P. Booz, City Engineer, Perth Amboy, New Jersey.

Opening Morning Session—October 9th—Special Order

Discussion of Report of Committee to Study Methods and Costs of Different Garbage Disposal Systems—led by Mr. Elmer C. Goodwin, Examining Engineer, Department of Street Cleaning, New York City—Three-minute talks.

The officials of the International Association of State Sanitation Officials are as follows:

President, Theodore Eichhorn, Superintendent, Department of Streets and Public Improvements, Erie, Pa.; First Vice-President, Robert B. Brooks, Director, Streets and Sewers, St. Louis, Mo.; Second Vice-President, Elmer C. Goodwin, Examining Engineer, Department of Street Cleaning, New York City; Third Vice-President, A. B. Cook, Chief Sanitary Inspector, Charlotte, N. C.; Secretary, A. M. Anderson, 10 South LaSalle Street, Chicago, Ill.; Treasurer, P. J. Hurtgen, Director of Public Works, Kenosha, Wis.

New Purification Plant of Greenwich Water Co., Greenwich, Conn.

New Installation Has Many Special Features

By E. SHERMAN CHASE
Of Metcalf & Eddy, Consulting Engineers, Boston, Mass.

IN line with a policy of providing an adequate supply of water of high quality, the Greenwich Water Co., under the guidance of its president, Eben F. Putnam, has recently constructed and placed in operation a modern water purification plant. This plant consists of a low lift pumping station, aerators, chemical mixing tanks, coagulation basins, rapid sand filters, clear water basin and chlorination equipment.

As constructed the coagulation basin has a rated capacity of 6 m.g.d., the filters 4 m.g.d. and the clear water basin storage of 1 m.g. The coagulation basin has excess capacity in order to permit its use in conjunction with existing pressure filters. The plant is so laid out as to be capable of ultimate expansion to 8 m.g.d. capacity.

Intake and Low Lift Pumping Station.—The existing Putnam Lake intake serves the new plant through a branch of the 30-in. pipe which originally served the pressure filters directly. In order to increase available storage and to provide adequate head after filtration, the filter plant was placed above high water level on the side hill just downstream from the reservoir, and a low lift pumping station was provided.

This pumping station is a one-story brick structure with a main pump room 22 ft. x 42 ft. inside with two wings approximately 11 ft. by 14 ft. inside. In one wing is emergency chlorine equipment for treating raw water should it ever be necessary to bypass the filter plant. In the other wing are toilet facilities and in the basement are heating equipment and coal bunker.

The pumping equipment comprises two motor-driven, horizontal centrifugal pumps. The pumps were manufactured by the Warren Steam Pump Co. with rated capacities of 8 m.g.d. each. Reservoir water comes to the pumps under a gravity head of about 20 ft. with full reservoir, the head varying according to water level in the reservoir. The raw water is pumped to the filter plant, either to aerating nozzles or to the chemical mixing tanks. Regulation of pumping is secured by means of a butterfly valve in the discharge line automatically controlled by the water level on the filters. As the water level over the filters rises, the valve closes, thereby increasing the friction head against the pumps and reducing the discharge, the reverse being the case with falling water level on the filters. Variable speed control is also provided for the pumps to permit of economical operation. A Venturi meter is installed on the 24-in. raw water discharge from the pumps and a recording indicator register is located in the office of the chemical house.

Aeration.—Aeration is provided by 48 Sacremento type nozzles located on the roof of the coagulation tanks. These nozzles are symmetrically placed in a grid of cast iron pipe raised on concrete piers above the roof. There are six rows of 8 nozzles each. The sprayed water falls upon the roof and thence drains to a conduit leading to the chemical mixing tanks. The nozzles have 2 lb. cones and throw a spray of approximately 17 ft. in diameter with a nozzle head of about 5 ft. Three sides of the aeration roof are surrounded by a fence of corrugated zinc 7 ft. 6 in. high. On the fourth side are the control valve and walkway.

Chemical Mixing Tanks.—There are two tanks in which the aerated water receives the dose of chemicals. These tanks are 18 ft. square in plan and carry a water depth of 17.5 ft. Adequate mixing is secured by mechanical stirrers consisting of wooden paddles operated by electric motors and so geared to these motors as to revolve at a rate of about one revolution per minute. Interchangeable sets of gears are also provided for other speeds. With the plant operating at its ultimate capacity of 8 m.g.d. these tanks give a total mixing period of approximately 15 minutes. Each tank is provided with 24-in. inlet and outlet and with a 12-in. drain.

For application of chemicals there are three motor-operated No. 3 Gauntt dry feed machines and space is provided for a fourth. The chemicals used are ordinary filter alum (sodium aluminate) and soda ash. The dry chemical is fed to the machines through hoppers from the chemical storage room on the floor above. In the two alum machines a stream of water mixes with and dissolves the chemical and the solution thus made is fed by gravity through rubber hose to the water entering the mixing basins. The soda ash is applied in a similar way to the filtered water as it leaves the filtered water reservoir, to neutralize the increase in acidity brought about by the use of alum. The chemical feed machines have been calibrated and control of chemical application is very accurate. If it proves necessary in the future the fourth chemical feed machine can be installed for adding soda ash to the raw water, although generally the raw water contains adequate alkalinity to react with the alum.

Settling Basins.—There are three settling basins, or rather one basin divided into three separate compartments by partition walls. Each compartment is 95 ft. long by 33 ft. wide inside, with a central, longitudinal baffle wall of plank around which the treated water flows before passing over outlet weirs to a channel leading to the filters.

The basin is covered by a flat slab roof supported on 15 columns. The maximum water depth varies from 14 ft. to 16 ft. 6 in. as the floor pitches to 12-in. drains. The distance between water level and underside of roof averages about 2 ft. Access to the basin is provided by 12 manholes, four over each compartment.

One end of the basin consists of a hollow wall 3 ft. wide inside, with horizontal partitions forming conduits about 4 ft. deep. These conduits starting with the uppermost, serve the following functions: first, convey aerated water to the chemical mixing tanks; second, convey chemically treated water and settled water from the settling basins to the filters; third, convey chemically treated water from the mixing tanks to the settling basins; fourth, drain the settling basins. Near one end of these channels is a bypass chamber with adjustable weir over which a portion of the chemically treated and settled water is discharged to a pipe leading to the old pressure filters.

The settling basin gives a theoretical detention of 4 hours with a flow of 6 m.g.d. For the ultimate capacity of 8 m.g.d. a fourth compartment will be added. Conduits, piping, etc., are arranged so that their addition can be made with little difficulty.

Filters.—The ultimate capacity of filters is 8 m.g.d., but at present only 4 m.g.d. capacity has been provided. There are now eight units of filters located in a wing extending from one side of the chemical house. The future units will be located in a second wing extending symmetrically from the opposite side. Each unit has a capacity of 0.5 m.g.d. at a rate of filtration equivalent to 125 m.g.d. per acre.

The filter boxes are of reinforced con-

crete, 12 ft. 8 in. by 16 ft. 6 in. in plan, inside dimensions, and 10 ft. deep from floor to top. Across one end of each filter box is a concrete baffle wall extending from the floor to within 2 ft. 7 in. of the top of the box. This wall forms an inlet chamber through which settled water is applied to the filters and from which wash water is discharged. The net filtering area of each filter is 12 ft. 8 in. by 13 ft. 10 in. or 175 sq. ft.

The filter medium consists of 30 in. of sand over 18 in. of graded gravel. The specifications for sand called for an effective size of not less than 0.30 mm. nor more than 0.40 mm. and a uniformity coefficient not greater than 1.60. In the case of six filters Cape May sand was used having an effective size of 0.36 to 0.37 mm. and a uniformity coefficient of 1.48 to 1.55. For the remaining two filters Cow Bay sand was used having an effective size of 0.37 mm. and a uniformity coefficient of 4.65. The use in two of the filters of Cow Bay sand whose uniformity coefficient departed so materially from that which has been considered good practice, was due to the desire to determine on a working scale whether this sand would accomplish satisfactory results. Furthermore, the cost of the Cow Bay sand delivered, was less than that of the Cape May sand.

The underdrains consist of 3-in. cast iron pipe laid 6 in. center to center over the filter floor. These pipes are provided with ¼-in. holes on the two lower quadrants, these holes being staggered on 6 in. centers. The underdrains of each filter connect through vertical tees to a central concrete conduit from which filtered water passes through a Builders Iron Foundry rate controller to the main effluent pipe leading to the clear water basin.

Each filter unit contains two wash water troughs of steel, 16 in. wide and painted. The tops of the troughs are 2 ft. 6 in. above the surface of the sand.

Wash water from the clear water basin is provided by two motor-operated, automatically primed, centrifugal pumps discharging directly to the filter underdrains through a 16-in. pipe. These pumps have a capacity each of 4 m.g.d. One pump at a time is operated for filter washing and is started and stopped by push button control in the operating gallery. The normal vertical rise of wash water over the filters is 24 in. per minute.

Clear Water Basin.—The clear water basin is a covered reinforced concrete structure 74 ft. wide by 150 ft. long inside dimensions with a maximum water depth of 12 ft. 6 in. equivalent to a capacity of 1 m.g. The whole basin is covered by a slab roof supported by three rows of columns. The top side of this roof pitches to its perimeter around which is a low concrete wall so that a secondary aerator for filtered water can be installed if future experience shows the necessity for such installation.

The corner of the basin nearest the filter house is partitioned off forming a compartment about 17½ ft. x 36½ ft. This compartment is also divided in halves along its length by a wooden partition. The object of this compartment is to provide ample contact period for the chlorinated filter effluent before mixture with stored water. An electric light is provided at the bottom of this compartment so that observations can be made of the turbidity of the filtered water.

Inlet and outlet pipes are 24 in. in diameter. In addition a 6-in. drain leads from one end of the basin to the main drain from the filters. In one corner of the reservoir is an 8-in. vertical riser which contains the water level gage.

Chemical House.—The chemical or head house consists of a two story and basement main building and two wings of one story and basement. A third wing will be added when more filters are built.

The first floor of the main building contains the entrance vestibule, corridor, office, laboratory and toilet facilities. An ornamental fountain is in this corridor facing the entrance. One wing of the building covers the filters and operating gallery under which is the pipe gallery. The other wing covers the chemical mixing tanks and appurtenances.

The basement of the main building contains the wash water pumps and motors, a service pump, heating boiler, coal bunker, locker room, toilet, domestic water supply and elevator machinery. From one side of the main basement the filter pipe gallery leads and from another side a gallery extends around the chemical tanks.

The second floor contains the chemical storage room and chlorine room. The chlorine room houses two vacuum type Wallace & Tiernan chlorinators for applying chlorine to the filtered water prior to entrance to clear water basin. An electrically operated service elevator runs from the basement to the second floor.

Pipe Gallery.—The pipe gallery is 14 ft. wide by 16 ft. high. The uppermost pipe is the 20-in. settled water pipe from which 8-in. branches lead to each of the filter units. Next below is the 16-in. wash water pipe with 16-in. branches to the filters. Beyond the wash water pumps and on this 16-in. line is a wash water rate controller tube with indicating, recording and registering apparatus in the office. Below the wash water pipe is the filtered water pipe, 20 in. in diameter from which 6-in. branches lead to 20-in. headers from the filter underdrains. Builders Iron Foundry rate controllers are located on each of these 6-in. branches. The lowermost pipe is an 18-in. tile drain, surrounded by concrete, on which are concrete junction boxes which in turn connect with the inlet compartments of the filter boxes through 16-in. pipes. Four-inch bypass pipes permit filtering to waste into the drain. All pipes are provided with the necessary hydraulically operated valves controlled from operating tables on the floor above. A plank walk extends along the gallery just above the filtered water pipe. Sampling cocks are provided on each filter outlet. The chlorination apparatus is connected to the 20-in. filtered water pipe ahead of the clear water basin shortly before the pipe leaves the basement of the chemical house.

Special Features.—In designing the plant, an attempt has been made to reduce the amount of supervision required in the operation of the various parts. Several automatic and remote control features have been installed for this purpose which deserve a short description.

The low lift pumps are equipped with slip ring motors which permit of adjustable speed control. Extension relay circuits for the control apparatus have been placed in the office of the chemical house and the speed of the pumps may be controlled from either the chemical house or low lift pumping station.

A special apparatus consisting of a float, differential mechanism, 4-way valve and pivot valve, controlled by the water level on the filters regulates the flow through the plant by throttling the discharge of the low lift pumps.

The necessary valves controlling the inlet, outlet, wash water and drain ports of the filter units have been made to operate hydraulically from hand levers on the operating tables. This permits all necessary valves to be operated on the table top in front of each unit.

Instead of the usual wash water tank for washing the filters, there has been installed duplicate wash water pumps. These pumps may be started and stopped from a push button station in the filter wing. There are also telltale lights in the operating gallery to indicate which pump is running.

An automatic priming device has also been included which keeps the pumps primed at all times and on failure of the priming system throws out the electrical circuit so that the pumps cannot be started until the priming is complete.

In addition, a rate controller has been placed on the discharge of the pumps which automatically holds the rate of washing on the filters constant.

An annunciator has been placed in the office with connections indicating high and low water in the filtered water reservoir. Low pressure is also indicated in the domestic water supply system which furnishes motive power for the hydraulic valve. The annunciator operates an industrial howler.

Interconnecting telephones have been installed between chemical house, low lift pumping station and the old pressure filter plant. In addition there is a public telephone connection to take

care of emergency calls from various parts of the distribution system.

Miscellaneous.—For service water for flushing, lawn sprinkling and other general but intermittent uses a 250 g.p.m., motor-driven, centrifugal pump and piping system to points of expected use have been provided.

A surface drain removes condensation and leakage collecting in the basement of the chemical house.

Water supply for the laboratory, toilets and operation of hydraulic valves is obtained from small, pneumatic pressure tank systems installed in duplicate. These tanks are of 500 gal. capacity each, water from the clear water basin being pumped into them by 50 g.p.m. centrifugal pumps. A pressure switch has been installed on the domestic supply pumps to permit the pumps to start when the pressure in the pneumatic storage tanks falls below a certain limit and to stop the pumps when the proper pressure is restored to the system. A small air compressor is also provided for adding air to the tanks from time to time.

The sewage from the toilets of pumping station and filter plant is discharged into leaching cesspools. The wash water and other drainage is discharged into the stream below the reservoir.

Operation.—The filter plant was first put into regular operation the latter part of April, 1928. It is operated under the general supervision of W. Jay Willson, superintendent of the Greenwich Water Co. and under the direct supervision of Harold C. Chandler, Chemist-in-Charge, who was formerly chemist at the Cambridge, Mass., filter plant.

During the period of tuning up some trouble was experienced with the water level controller regulating the discharge from the low lift pumps. This trouble was remedied by changing the gearing connected to the cam operating the pilot valve controlling the hydraulically operated butterfly valve in the discharge pipe from the pumps.

Filter runs between washing were also unduly short during the first few weeks. Increasing the rate of washing of the filters to about 30 in. vertical rise per minute and scraping off the top 2 in. of fine material resulted in an improvement in filter runs. Copper sulphate treatment of Putnam Lake also may have been of some value in destroying microscopic organisms which if reaching the filters in any quantity would tend to decrease filter runs.

An interesting feature of the purification plant is the operation of the old pressure filters in parallel with the new gravity filters. The preliminary treatment of the raw water by coagulation and settling at the new plant prior to the application of this water to the pressure filters has brought about a marked improvement in the quality of the effluent from these filters. Inasmuch as it was desired to prevent any increase in corrosive properties of the filtered water, resort has been had to the application of soda ash to the filtered water. This application is made by one of the dry feed chemical machines at the new plant to the water drawn from the clear water basin. The water from the basin flows by the old filter plant in the 30-in. pipe originally carrying raw water to these filters. Below the old filters cross-overs exist which permit mixing of the effluents from both old and new plants. By overdosing with soda ash the effluent of the new plant and by chlorinating it with the chlorine equipment formerly used for chlorinating the pressure filter influent the effluent of the pressure filters is corrected for corrosive qualities by the excess soda ash and disinfected by chlorine carried in the effluent from the new plant. To apply soda ash directly to the pressure filter effluent would require an additional chemical feed machine and injector equipment. Direct chlorination of the pressure filter effluent would have required further changing of equipment. The results obtained by the present method of operation appear to have been satisfactory.

Operation Data.—In general, the quantity of water treated by both filter plants has averaged about 3 m.g.d. each or 6 m.g.d. total. In the case of the new plant the average length of filter runs gradually increased from 8½ hours in May to 11 hours in August. The pressure filters during this period have required washing but once daily. This has been due, in all probability, to the coarser sand in these filters. The per cent of wash water required has been approximately 5½ per cent with the new filters and 3½ per cent with the old. The higher per cent required for the new filters has been largely incidental to the tuning up process. In August the figures were 4.0 per cent and 3.0 per cent, respectively. In general the alum application has been at a rate of 0.9 grains per gallon and the soda ash at 10 p.p.m. The chlorine dose has averaged about 0.5 p.p.m.

Operation Results. — The combined filter plants have produced a clear, practically colorless and non-corrosive water. Turbidity has been reduced from about 3 p.p.m. to zero, and color from about 25 p.p.m. to 3 p.p.m. The pH of the delivered water has averaged about 7.0. Bacteria have been materially reduced. The average 20°C. gelatine counts per cubic centimeter have been about 500 in the raw water and 2 in the delivered water. The 37°C. agar counts have been reduced from 95 to 2 per cubic centimeter. The raw water usually contains organisms of the B. coli type in 10 c.c. inoculations and occasionally in 1 c.c. At no time has the delivered water given confirmed tests for these organisms. In brief, the Greenwich Water Company is delivering a safe and attractive water.

The new purification works were designed by Metcalf & Eddy, and constructed by Stone & Webster, Inc., with Mr. Carlton F. Green, construction superintendent. The Greenwich Water Co. is a subsidiary of the Community Water Service Co., of which Reeves J. Newsom is vice-president and chief engineer.

Acknowledgment.—The above is an abstract of a paper presented at the 1928 Convention of the New England Water Works Association.

Asphalt Paving Conference

Conflicting meetings have made it necessary to move forward the date for the Seventh Annual Asphalt Paving Conference to be held this year in New Orleans and, accordingly, the meeting will be held during the week of Dec. 3rd instead of that of Dec. 10th, as previously announced. The technical sessions will continue for three days, beginning on Tuesday, Dec. 4th, and continuing until Friday, Dec. 7th, when the conference will close with a golf tournament and the award of a number of handsome prizes to the winners. An exceptionally interesting and informative program of technical discussions and novel entertainment features have been provided. The Association of Asphalt Paving Technologists, The Asphalt Association, and the local committees are cooperating to make this conference even more successful than the six which have preceeded it.

For the first time in the history of the conferences, asphalt paving at airports will come in for thorough discussion. Among those who are expected to participate in the airport session are William P. MacCracken, Assistant Secretary of Commerce in charge of aeronautics; Col. H. H. Blee, Engineer for the Aeronautical Division, Department of Commerce, and several consulting or construction engineers prominent in the work of designing and building commercial and municipal airports.

The program will also present new and far-reaching economic and technical questions of vital importance to the good roads movement. The vast possibilities in the surface treatment of the many hundred thousand miles of roads that constitute the secondary highways of the country will be dealt with from the economical, technical and practical construction standpoint by a selected group of authorities headed by E. W. James, chief of the Division of Design, U. S. Bureau of Public Roads.

Radical strides in the development have been made recently in the mechanical equipment and operations involved in the construction of asphalt pavements and in the technique of asphalt construction, and these developments will be presented by men who have first-hand knowledge, including T. Warren Allen, Chief of the Division of Control, U. S. Bureau of Public Roads; M.

H. Ulman of the Pennsylvania State Highway Department; Prevost Hubbard, Chemical Engineer of the Asphalt Association, and others of equal authority and prominence.

Remarkable service results in the use of asphaltic concrete (black base) in California have induced the attendance of one or more prominent engineers from that state to present the results of their experience to the conference. Chris P. Jensen, County Engineer of Fresno County, California, one of the best authorities on this type of construction in the United States, is expected to present his experience with this type of paving.

Another feature of importance from the standpoint of practical first-hand information will be a series of papers by the heads of various state highway departments telling what results they have obtained with all forms of asphaltic construction and surface treatment. Seven of the states which have had wide and useful experience along these lines are Massachusetts, Michigan, Louisiana, Tennesse, North Carolina, Georgia and California, and also the Province of Ontario.

The first day, Monday, will be devoted to registration and committee meetings. On Monday evening there will be an open house reception arrangement. Light refreshments will be served. The Reception Committee will see that everybody becomes acqainted and there will be a few entertainment features to liven up the evening. Tuesday will be devoted to the opening morning session followed in the afternoon by a boat ride and inspection trip on the Mississippi River and Lake Ponchartrain, with the New Orleans Refining Co., as host. The asphalt technologists will meet in the evening. On Wednesday there will be morning and evening technical sessions and the afternoon will be devoted to a specially conducted trip to the race track where the Standard Oil Co. of Louisiana will be host to those attending the convention. On Thursday there will be morning and afternoon technical sessions. During the day a special social function is arranged for ladies, consisting of a luncheon with a talk by Dorothy Dix, and a trip through the French quarter of New Orleans. Thursday evening there will be a carnival ball with the Mexican Petroleum Corporation as host. This ball will be a replica of one of the famous Mardi Gras balls and will be held at the Athenaeum. The City of New Orleans will provide special street lighting and special details of police and firemen for this event. On Friday will be held the golf tournament.

A very strong local committee on arrangements has been created with John Klorer, New Orleans city commissioner of public property, as chairman. Mr. Klorer has charge of all paving for the City of New Orleans. He is also Vice-President of the American Society of Municipal Improvements and is an outstanding figure in municipal work in this country.

The local sub-committee chairman assisting in the arrangements are as follows: Committee on Entertainment Features, T. Semmes Walmsley, commissioner of public finance, City of New Orleans; Committee on Reception and Welfare, William T. Hall, commissioner of public utilities, City of New Orleans; Committee on Official Contact, Paul B. Habans, commissioner of public safety of New Orleans; Committee on Transportation, Walter Jahncke, president, Jahncke Service, New Orleans; Committee on Publicity, Harold Wright, aide to Mayor O'Keefe; Committee on Registration, Sam Fowlkes, manager, New Orleans Convention Bureau; Ladies' Committee, Mrs. George Penrose; Committee on Golf Tournament, Thomas Taylor, sales manager, Standard Oil Company of Louisiana; Committee on Special Features (1) Carnival Ball, W. R. Wilkinson, for the Mexican Petroleum Corporation (2) Boat trip, L. M. Law, for the New Orleans Refining Company (3) Race track party, H. C. Ehrenfels, for the Standard Oil Company of Louisiana.

A national Engineering Committee, upon which will appear the names of some of the foremost engineers in the United States, is being constituted under the chairmanship of Maj. J. M. Fourny, State Highway Engineer of Louisiana. A Research Committee is also being formed with W. J. Emmons, Associate Professor of Civil Engineering, of the University of Michigan, as chairman. The personnel of this committee will be selected by the Association of Asphalt Paving Technologists of the United States and Canada, of which Mr. Emmons is First Vice-President.

Presiding officers at the various sessions will include chairman, State Highway Commission of Louisiana; J. N. Holder, Chairman, State Highway Board of Georgia; Capt. H. C. Whitehurst, Assistant Engineer Commissioner of the District of Columbia; John M. Mackall, Chairman of the Maryland State Road Commission, and others.

Smoke Violations in St. Louis

During the month just ended thirty-one violations of smoke regulations were corrected by the city of St. Louis, Mo., according to a recently issued monthly report of Smoke Commissioner Gordon.

Of the violations thirteen were perpetrated by industrial plants, twelve by apartments and six by bakeries. Twenty-eight of the violations were corrected by a change from soft coal to coke as fuel, two violations were due to defective equipment, and one was caused by a low chimney.

Sanitary Service at St. Paul, Minn.

The city of St. Paul, Minn., has 426 miles of streets graded only, 215 miles of paved streets and 14 miles of paved alleys. The following interesting information on the sanitary services for these streets in 1927 is taken from the recently annual report of John H. McDonald, Commissioner of Public Works:

The paved areas—streets, bridges and alleys—amount to 4,957,954 sq. yd. Of this, 61 miles, or an area of 1,433,000 sq. yd., are cleaned by hand sweeping under the patrol system. The districts for each sweeper vary from 3,200 sq. yd. in the business district to 17,000 sq. yd. in the residential sections.

Snow removal, including sanding of walks and steps, amounted to $90,732, of this the street railway company paid as their portion $10,182.

In addition to the sweeping service, all paved streets are cleaned with water periodically. This is done with Studebaker flushers and auto flushers. One hundred and sixty-six miles of streets were flushed. In the retail district the streets are flushed every night. In the outlying districts flushing is done as required.

An interesting change has taken place in the matter of reducing the dust nuisance. In 1922 184 miles of streets were water sprinkled. During that year all street sprinkling on paved streets was stopped, the dust nuisance being taken care of by more frequent cleaning, thus removing the dirt which made the dust. One hundred and sixty-seven miles of paved streets are now flushed; 17 miles of dirt streets water sprinkled for the entire season and 259 miles of dirt streets treated with oil.

The rate for water sprinkling, four trips per day, was 12 ct. per frontage foot, or $4.80 for a 40-ft. lot, for the season. The rate for oiling, two oilings per season, an average width of 24 ft., was 5.28 cents per foot, or $2.11 per 40-ft. lot. The oil is distributed by Kinney auto oilers, using $1,020,000 gal. of road oil.

When dust was laid by flushing the following rates were used:

	Per Frontage Foot, Ct.
Night flushing, daily	14
Flushing every five days	2.5
Flushing twice a week	4
Flushing once a week	2

A total of 62,747 lots or parcels of land were assessed for sprinkling and oiling. Some of the lots were assessed for both, making a total of 95,140 seperate assessments.

During the year 49,776 lin. ft. of sewers have been flushed with fire hose. This required 4,750,000 gal. of water. The Water Department was reimbursed on a basis of 40 ct. per hour (459 hours) for the time hydrants were open during this flushing. The charge of 40 ct. per hour was based on an average of meter readings taken at various hydrants in this city.

The Control of Municipal Construction Operations

Check-Up Forms Used by Construction Engineers to Insure Good Workmanship and Proper Materials

By ARTHUR W. CONSOER
Consoer, Older & Quinlan, Consulting Engineers, Chicago

ONLY rarely are engineering designs or specifications found to be faulty on municipal projects. For most of the construction work undertaken by municipalities approved specifications and methods of design sanctioned by good engineering practice are easily available to the municipal engineer; and only occasionally is he called upon to make designs or write specifications for work that has not been, more or less, successfully standardized.

When difficult or unusual problems of design are presented they are usually properly worked out by competent designers, because engineering literature of recent years contains very few recitals of improper design on municipal projects.

However, examples of poor construction work are regrettably common on municipal work. In small villages and in some of our largest cities charges and counter charges regarding improper construction of public works appear frequently in the press and in political campaigns. Naturally many of the charges have no foundation in fact; and yet it must be admitted in the construction industry that cases of unsatisfactory construction are all too frequent in the municipal field.

Where bad management in the control of municipal construction operations exists it may be due somewhat to the fact that on most projects a comparatively small group of designing engineers is concerned with the preparation of plans and specifications and a much larger group of men is concerned with the supervision and inspection of the construction operations.

Ordinarily it is not difficult as a problem in management for the engineer in charge to insure careful and accurate designing of public works. The small group of designing engineers is usually free from the plagues of nepotism and political patronage. Tenure of office is usually secure for this part of the city engineer's staff. It is generally possible for the designing staff to develop an esprit de corps which makes impossible any unsatisfactory work in design or the preparation of specifications.

But on the construction operations with a much larger group of men employed as supervising engineers and inspectors, and with the contractors' selfish interests always present, a much

Date.....
Town..... Project.....
Subgrade..... Depth water mains below sub-grade.....
Location of weak spots and reinforcement[1].....
Quality of Materials..... Tests.....
Proportioning..... Bulking of sand[2].....
Cement count by inspector daily.....
Records of cement check..... Cast iron covers.....
Quality of mix..... Time.....
Water content..... Water meter..... Daily check.....
Joints..... Thickness..... Kind..... Straightness.....
High joints..... Truly vertical.....
Placing of joints as to curb dowels in block and at intersections.....
Do alley returns provide for drainage.....
Smoothness..... Straight edge.....
Slip dowels slip[3]..... Curb dowels[4].....
Finish..... Hair cracks.....
Burlap on hand to protect against sun and rain.....
Parkways and cleaning up..... Steel end plates.....
Mesh required..... Used.....
Reinforcing steel.....
Sewer and water stubs in..... Extensions S & W in.....
Barricades..... General appearance.....
Cold weather precautions.....
Zero walks[5].....
Per cent completed..... Probable date of completion.....
Inspectors on slab..... On plant..... Have specifications[8].....
Construction record[6]..... Record filed in leather roll[7].....
.....
Remarks .....
.....
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.....
.....
Engineer.

Form I—Construction Report—Paving

Explanatory Notes:
[1]Location of weak spots in subgrade.
[2]Specifications provide for varying proportion of sand with actual moisture content as determined by daily tests.
[3]Slip dowel bars across transverse expansion joints are used. These dowels are three-quarter inch round smooth bars, provided with metal caps on each end and lubricated to provide for expansion and contraction. They must be carefully installed so that they slip and allow the joint to serve its purpose.
[4]Curb dowel bars are used with separate curb and gutter to dowel the curb and gutter section to the pavement slab.
[5]In some residential sections, warped intersections are built which provide for a zero curb exposure at the cross walk thus avoiding an objectionable step at the cross walk and providing a dry cross walk. This item in the report is a reminder to the inspector or construction engineer to check the plans for any intersection of this type which might be overlooked.
[6-7]The inspector's daily notes on quality and quantity of materials used, location, weather conditions and any other pertinent information. This data is compiled into a brief summary when the project is completed and filed with a complete set of plans in a leather roll for that purpose in the office of the clerk of the municipality. No project is considered complete until "yes" can be written in after number 7.
[8]A reminder to the construction engineer to ascertain if all inspectors are provided with a complete set of specifications.

Date.....
Town..... Project.....
Location .....
Subgrade .....
Quality of materials..... Tests of materials.....
Proportioning .....
Cement count by inspector daily.....
Quality of mix..... Time of mix.....
Thickness of base..... Top.....
Joints..... Finish.....
Curing..... Top placed..... Min. after base.....
Bank grading and berms.....
Cross slope[1]..... Vertical curves[2].....
General appearance.....
Inspector..... Has specifications[3].....
Record of cement check.....
Construction record[4]..... Record filed in leather roll[5].....
Per cent completed..... Probable date of completion.....
Remarks .....
.....
.....
.....
.....
.....
Engineer.

Form II—Construction Report—Sidewalks

Explanatory Notes:
[1]Proper cross slope from edge of walk nearest the lot line toward the centerline of the street is necessary for drainage of the walk. This small item is sometimes forgotten by careless contractors.
[2]Appearance of vertical curves.
[3]See foot note 8 under paving (Form I).
[4-5]See foot note 6 and 7 under paving (Form I).

Curb and Gutter

Date.....

Town..... Project.....
Location.....
Subgrade..... Subgrade testing with rod[1].....
Quality of materials..... Tests.....
Proportioning..... Bulking of sand.....
Cement count by inspector daily.....
Quality of mix..... Time..... Honeycomb.....
Water content..... Water meter..... Daily check.....
Form settling..... Vertical curves.....
Joints..... 1 in. on curbs..... Finish.....
Joints truly opposite..... Dowels.....
Curing..... Cutter drainage tested.....
Burlap on hand to protect against sun and rain.....
Reinforcing..... General appearance.....
Cold weather precautions..... Curbs backfilled.....
Per cent completed..... Probable date of completion.....
Inspector..... Has specifications.....
Zero walks.....
Remarks .....

Engineer.

Underground Work[2]

C. B. construction[3]..... Connections tested.....
Location.....
Inlets and connections..... Connections tested.....
Inspector..... Has specifications.....
Locations marked for paving inspector..... Sketches[4].....
Tests for depth of water mains.....
Sewer and water extensions in.....
Sewer and water stubs in.....
Gas and public service pipes and conduits in.....
Poles moved.....
Water valves in basins..... Basins drained.....
Per cent completed..... Probable date of completion.....
Remarks .....

Engineer.

Form III—Construction Report—Paving for Curb and Gutter and Underground Work

Explanatory Notes:
[1]Subgrade is tested frequently for weak spots by means of a steel bar. These tests are usually made by the curb inspector and weak spots reinforced by steel reinforcing in the curb and gutter and pavement slab.
Other items in the report on curb and gutter are similar to paving items.
[2]Applies only to drainage work incidental to paving construction.
[3]Catchbasins.
[4]Showing locations of all connecting pipes for inlets and catchbasins as actually built.

Date.....

Town..... Project.....
Location.....
Size sewer pipe..... Required thickness..... Tickness used.....
Pipe laying..... Grade of stubs..... Stoppers.....
Depth cover..... Riser pipes braced..... Backfill tamped.....
Sidewalks notched[1]..... Line level used[2].....
General condition..... Cleaning up.....
Size and weight of lead pipe..... Goosenecks blocked.....
Depth cover..... Length shut-off box.....
Type of shut-off box..... Elevation of top.....
Backfilling tamped..... Weight of brass fittings.....
Hydrostatic tests..... Water flow tests.....
Sidewalks notched..... Cleaning up.....
General condition.....
Per cent completed..... Probable date of completion.....
Inspector..... Has specifications.....
Construction record, locations, etc.[4].....
Record filed in leather roll[4]..... Records on linen Atlas sheets[5].....
Final inspection made by field and construction engineers.....
Remarks .....

Engineer.

Form IV—Construction Report—Sewer and Water Stubs

Explanatory Notes:
[1]Sidewalks notched for location of sewer or water service pipe.
[2]To obtain proper grade on sewer stub.
[3-4]Same as 6 and 7 under Paving, except that plan also shows exact location of each service as constructed.
[5]In some municipalities bound sewer and water atlases have been prepared on linen prints. The locations of all sewer or water stubs are posted in these atlases in lieu of filing a plan.

Date.....

Town..... Project.....
Location.....
Quality and size of cable.....
Height, dimensions, quality of posts.....
Proper equipment[1].....
C. P. or wattage of lamps.....
Laying of cable.....
Post foundations.....
Grade of posts..... Alignment of posts.....
Transformers..... Transformer basins.....
No sharp bends in cable in manhole.....
Individual transformer connection sockets filled with waterproofing compound.....
Proper size fuses or cutouts in group transformers.....
Construction record in leather roll[2].....
Per cent completed..... Probable date of completion.....
Inspector..... Has specifications.....
Remarks .....

Engineer.

Form V—Construction Report—Electric Lighting

Explanatory Notes:
[1]This item covers such accessories as cut-outs, lightning arresters, time clocks, etc.
[2]Same as other records. It is important that exact locations of underground cables are known to avoid trouble on future construction.

more serious problem in management is presented to the engineer in charge.

Frequently the construction forces for supervision and inspection must be built up rapidly with many new supervising engineers and inspectors whose experience and integrity is still to be definitely determined. New men in an organization, even if possessed of excellent ability and previous experience are apt to interfere with the smooth and proper functioning of a construction program. Inspectors long in the service of a construction organization, particularly the political appointees, if there be such, are apt to slight important matters because of their very familiarity with such matters and the frequent occurrence of such matters on the job.

Construction work usually moves more rapidly than design work and the inspectors and supervising engineers are called upon to think more quickly and observe more sharply than is the case with the designers in the drafting room. The designer has ample time to review and check his designs and drawings but the inspector has usually lost almost all opportunity to review and check the construction operations, once they are completed according to a rapid profit making construction program by the contractor. The construction division of a municipal engineering organization is more apt to be troubled with political appointees and with political influence than is the design-division.

While the political appointee of insufficient experience and training is common as an inspector or supervising engineer in many municipalities where salaried staffs are employed, it is not at all uncommon for a consulting engineer in charge of municipal work to be requested to find employment for such men as inspectors. Probably the most difficult problem in management presented to the engineer engaged in municipal work is involved in the proper training and supervision of such political inspectors. Often such men can be trained and encouraged to do creditable inspection work. While they may enter the construction organization with little pride in the job and more or less without ambition frequently they can be imbued with a real sense of loyalty and will become just as jealous of the city's interests as men better qualified and better trained for inspection work. Where they cannot be so prepared for their duties, it is certainly incumbent upon the engineer in charge to cause their removal or to withdraw from the work itself. The latter action is decidedly the most difficult problem in management confronting the engineer engaged in municipal practice. However, unless he so manages such incidents he is bound to lose in professional prestige and in self-respect.

Various methods for improving the performance of inspectors and supervising engineers on municipal construc-

tion operations have been devised. Many municipal engineers, in an effort to obtain rigid inspection of construction issue manuals of instruction for the use of construction engineers and inspectors. The intent of such manuals is usually to standardize inspection methods and to assure a uniform high quality on the construction operations of the organizations. Such manuals are helpful in "breaking in" new men as inspectors.

Most organizations of this kind include one or more construction engineers whose sole duty it is to supervise construction and inspection. Such a construction engineer faces the problem involved in getting numerous inspectors disciplined to see things more or less the same and to obtain results or uniformly high quality on the construction operations. Specifications are often so lengthy and involved that the average inspector is apt to overlook some important items of the work unless a competent construction engineer confers with him frequently to check his performance on inspection of construction operations.

To assist construction engineers and inspectors in their work on a program of municipal construction work exceeding $12,000,000 of cost annually, check-up construction forms were devised by the writer and have been used successfully. The intent of these forms is to prevent lapses of memory as to important clauses of the specifications on the part of inspectors and construction engineers and to provide them with a definite schedule of things to do daily in inspecting each class of municipal construction work. These construction reports are not intended to supplant the specifications in any way, but have been used to supplement the specifications, and have proven very useful in improving the character of construction work carried on simultaneously in 37 different cities and villages in the Chicago Metropolitan Area.

Before preparing these forms for construction reports a record was kept for a year of the most common cases of oversight on the part of inspectors and the most common forms of complaint from property owners. The construction reports were then devised to prevent occurrence of such cases of oversight and complaint. During two succeeding years additional causes for oversight and complaint have been eliminated by necessary revisions in the construction reports.

The use of these construction reports has been very helpful in improving the quality of construction operations and has tended to make the operations of uniform quality in 37 different municipalities. Before commencing the use of these reports some of the inspectors were apt to consider themselves in the role of observers instead of in the role of inspecting engi-

Date.....

Town..... Project.....
Location .....
Quality of materials..... Tests.....
Cement count by inspector daily.....
Proportioning .....
Quality of mix..... Time..... Timing device.....
Water content..... Water meter..... Daily check.....
Calipering of mesh..... Tie wires.....
Placing of steel mesh.....
Shell thickness..... Trueness of internal diameter.....
Curing..... How done.....
Marking date of manufacture.....
Honeycomb[1]..... Dark ends[2].....
Reinforcing steel exposed[3].....
Sand streaks[4]..... Serial Nos. on rejected pipe.....
.....
Forms .....
Per cent completed..... Probable date of completion.....
Inspector..... Has specifications.....
Remarks .....
.....
Engineer.

Form VI—Construction Report—Concrete Pipe Manufacture

Explanatory Notes:
1-2-3-4These four items provide the most frequent causes for rejection of large concrete pipe and are therefore inserted to remind the inspector to watch for them particularly before accepting pipe.

Date.....

Town..... Project.....
Location .....
Size pipe..... Weight per ft. required..... Used..... Weight of fittings.....
Depth of cover below sidewalk grade..... Alignment.....
Hydrant setting..... Drainage of hydrants.....
Alignment of hydrants..... Grade of hydrants.....
Does grade of main agree with future paving grades.....
Tests..... Are valves opened after tests?.....
Final 24 hr. leakage tests.....
Backfilling..... Are valves opened and closed properly during tests?.....
.....
Construction record, mains, fittings, valves located—sketches, plans[1].....
.....
Valves—type and dimensions.....
Hydrants—Type and dimensions.....
Cold weather precautions.....
Pipes and hydrants all backfilled.....
Mains and hydrants flushed after completion.....
Flexible joint pipe under railroad tracks.....
Drain pipes cut and connected up[2].....
Cleaning up.....
Inspector..... Has specifications.....
Records filed in leather roll[3].....
Record on linen Atlas sheets[4].....
All new and old valves open after completion.....
Final inspection made by field engineer and construction engineer.....
.....
General conditions.....
Per cent completed..... Probable date of completion.....
Remarks .....
.....
Engineer.

Form VII—Construction Report—Water Mains

Explanatory Notes:
[1]The inspector's notebook showing exact location of fittings as installed, which notes are later transferred to the water main atlas.
[2]A frequent source of complaint on water main and sewer construction is failure to reconnect broken tile drains still in use.
3-4See previous foot notes.

Date.....

Town..... Project.....
Location .....
Size pipe..... Approximate cut..... Cradle.....
Cradle required[1]..... Cradle installed where required.....
Required thickness of pipe..... Thickness used..... Culling pipe.....
Age of concrete pipe..... Serial number on rejected pipe.....
Joints..... Kind[2]..... Using Jute..... Using.....
Condition of trench..... Width of trench specified..... Used.....
Is proper size joint material used?[3]..... Line level used.....
Pipe laying..... Batter-boards and top-line..... Gauge length.....
Gauge pole levels..... Foot check on gauge pole.....
Tamping ..... Cover..... Backfilling.....
Manholes ..... Materials..... Cones..... Covers.....
Manholes cleaned out..... Grade of covers..... Cleaning up.....
Infiltration tests..... Pumping.....
Catchbasins ..... Material..... Cones.....
Flow tests on catchbasins..... Tightness tests on catchbasins.....
Cold weather precautions..... Old services cut and connected up.....
Flow tests on sewers..... Mirror tests on sewers.....
Visual inspection of interior of large sewers.....
Per cent completed..... Probable date of completion.....
Inspector..... Has specifications.....
"Y" records[4]..... To date..... Walks notched.....
General condition.....
Construction record filed in leather roll[5].....
"Y" records on linen Atlas sheets[6].....
Final inspection made by field and construction engineers.....
Remarks .....
.....
Engineer.

Form VIII—Construction Reports—Sewers

Explanatory Notes:
[1]Concrete cradle for deep cuts. [2]Mortar or asphaltic compound.
[3]This applies if a preformed asphalt-jute gasket joint is used.
[4]Includes in addition to location of Y branches any other data as to details of construction.
5-6See previous foot notes.

neers with a fixed daily schedule of duties.

The inspectors are not required to fill in the report forms, but are instructed to use them as a guide or a memorandum. The construction engineers on their visits to the work fill out the reports, and in doing so make a very close check of the important items in the construction. These reports after being filled out are filed with other papers concerning the project and furnish an excellent record of the amount and kind of supervision and inspection on the project.

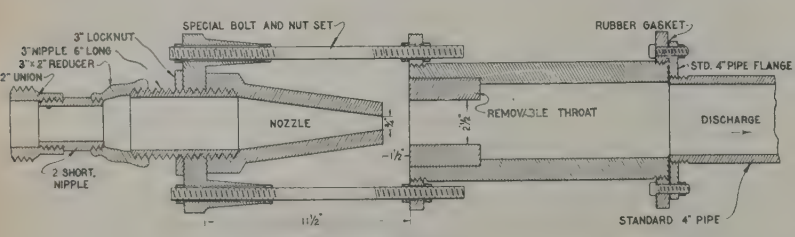
Reduction of Mud Balls in Filters

Mud balls forming in the sand bed at the Chain of Rocks filter plant of St. Louis, Mo., are disintegrated by jetting the sand from one end of the filter to the opposite end while wash water is applied to the filter. This is accomplished by means of a hydraulic ejector (Fig. 1). The pressure or nozzle end of the ejector is connected to provided with standard pipe fittings. a water plug with a 2½-in. water hose The discharge end of the ejector is fitted with standard pipe and fittings as required. The discharge pipe should be so assembled that it will act as a hanger for the jector, thus enabling the latter to be held in the floating sand at any desired depth. At the Chain of Rocks plant the discharge pipe is carried horizontally from the jector for a few feet, then with a 4-in. elbow and length of pipe the line is carried vertically, terminating in another 4-in. elbow and a long length of horizontal pipe extending toward the opposite end of the filter and resting on the concrete cross-beams. The vertical distance from the lower edge of the last length of the horizontal pipe to the edge of the spout on the ejector should be made such that, when the apparatus is hung on the cross-beams, the edge of the spout will be about 3 or 4 in. below the surface of the stationary sand. At the extreme end of the last length of horizontal pipe, the line is continued vertically downward for a short distance and there the discharge is reduced to 2½ in. with a 4x2½-in. reducer and a short 2½-in. nipple.

Under the discharge is placed a wooden box about 4 ft. high and 15 in. square, open at both ends and provided with three sloping screens, each 15x12 in. in plan. The screens are so arranged that one discharges onto another, while fastened to the top screen there is a small steel plate against which the discharge from the jector impinges. This steel plate tends to further disintegrate the mud balls.

Underneath this box there should be suspended a ⅛-in. mesh wire basket 2½-ft. square by 6 in. deep, the bottom of which should be a few inches above the overflow edge of the wash-water troughs. This will retain any small gravel that may come through the ejector. As fine gravel accumulates on this screen, it should be removed and scattered uniformly over the area of the filter while the wash-water is being applied. Without this screen fine gravel would tend to pile up underneath the box and cause an unevenness in the surface of the gravel bed.

When ready for jetting, the filter is first given a normal wash and then while the wash-water is still being applied, the apparatus is lowered into place. The rate of wash is then cut to about 5 gal. per sq. ft. per minute, which is continued for 15 minutes after which the rate of wash is momentarily raised to 10 gal. in order to level the sand bed. This increase and decrease of wash-water is continued every 15 min. for 5 hours, after which the apparatus is moved to the next filter. The amount of wash-water used during the 5 hr. period amounts to about 1,430 gal. per sq. ft. of filter area. The ejector may be moved about by four men.



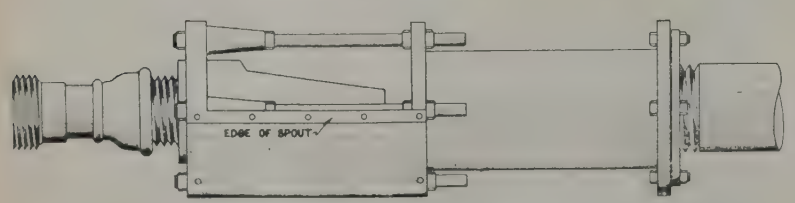


Fig 1—Details of Hydraulic Ejector

According to the last annual report of Leonard A. Day, Water Commissioner, by thus jetting the sand in the filters once every six months, the mud balls are very considerably reduced and part of the coating of the sand grains due to softening of the water is removed.

Wolf Diesel Engine Utmost in Simplicity

The Wolf compressorless stationary diesel engine, manufactured by the R. Wolf Co. in Magdeburg, Germany, and distributed in the United States by Morrill and Morrill, Sales Engineers, 30 Church St., New York City, is said to be a power unit that would prove particularly useful where the minimum of superintendence is available and where ability to use any of the heavier fuel oils is an advantage. This diesel is said to start easily by hand, requiring about four turns of the crank, and requires no supply of compressed air, cartridges, starting paper, or other means for starting, even when cold.

This is a vertical type engine and requires but little room for installation. There are no complex distribution gears, bevel wheels and pinions, shafts, gear rods and valve levers, nor mechanical inlet or exhaust valves, no compressor or scavenging air pump, no sensitive ignition devices, cables, and no carburetors to afford trouble. The machine is very simple and said to operate consistently for long periods and under heavy loads without a great deal of attention.

Complete information can be secured upon application to the distributors named above.

Piltometer Survey Results in Saving

A Piltometer water waste survey was recently made by Harrison Gray Otis, city manager, Rocky Mount, N. C., in his city, according to a report recently presented by him to his board of aldermen.

Briefly, in addition to the great value of a thorough inspection, and to the recommendations for improving the service, the report shows, among other results of the survey, a reduction in consumption amounting to 185,000 gal. per day, and an increase in revenue due to better metering of 45,000 gal. per day. These figures alone, which appear very conservative, according to his report, amount to a saving of $14.73 per day, or $5,376 per year, which capitalized at 6 per cent, equals $89,600. If the amount of money apparently due the city for use of unmetered water, and collectable is to be added, the report went on to state, the total cash value of the survey, from these items alone, appears to be over $100,000.

Comparison of Garbage Practice at Home and Abroad

An Interesting Account of European and American Methods

By FRANCIS L. PRUYN
The Decarie Incinerator Corporation, New York

IN the spring of 1927 the writer made a trip to Europe to inspect foreign incinerating methods in an endeavor to ascertain if improvements in our own apparatus and technique could not be made. It seemed reasonable to suppose, since Europe had incinerated its rubbish for a much longer period than the United States, that economies would be found that could be profitably adopted in our own country.

Conditions Different in Europe.—The writer visited incinerating plants in England, Italy, France and Germany and found the conditions governing all incineration entirely different from those found in the United States. Ashes are mixed with the rubbish, a condition which causes fundamental changes in the entire process. On account of economic conditions very little wood or paper is thrown away in the rubbish so that in order to produce sufficient heat for combustion it becomes necessary to include ashes which, with their high calorific value, will produce the necessary temperature.

The burning of ashes results in much higher temperatures than are required when complete odorless combustion is the only end in view. This can be obtained with temperatures ranging between 1,200 and 1,500 deg. F. The ashes produce a heavy clinker and as the common practice is to reduce this almost to a slag, temperatures are required in excess of 1,800 deg. F. In almost all instances the slag or clinker is utilized as a by-product, either by crushing for road material or by grinding and mixing with cement to produce brick. The furnaces are designed to conserve heat and with this in mind the charging, stoking and removing of clinker is done, as far as possible, without contact with the outside air.

In general the plants are more elaborate and more costly in design than those of the United States since the utilization of the by-products necessarily includes expensive apparatus and machinery. The waste heat from the furnace usually passes through high pressure boilers for the generation of steam before the gases reach the stack. The steam is either sold or used in the plant for its own operation as well as for the operation of the machinery required for the manufacture of the various by-products.

Incineration Plants in England.—In England the plants are largely of the type with which we are familiar in this country. They consist of high temperature brick incinerators and as their general design is similar to many plants now operating in the United States, the writer only visited the most modern plant in London, which was under construction at the time. This is situated at Fulham, a district of the City of London and consists of a new 200-ton incinerator. While the writer did not see the plant in operation he inspected a copy of the plans which showed a new system of double grates operated by hydraulic power. The clinker is scraped from one grate to the other without opening the furnace door and finally pushed out onto the floor of the furnace room without opening the doors of the furnace for stoking or other purposes.

Fig. 1—View of Plant at D'Ivry, Paris, France

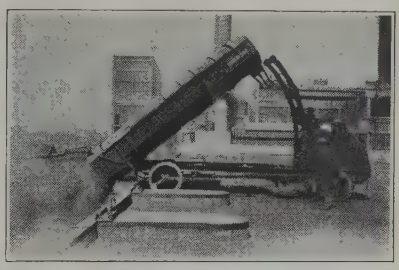


Fig. 2—Rubbish Truck Dumping Into Cars at D'Ivry Plant. The top of the Truck Is Closed with Steel Doors

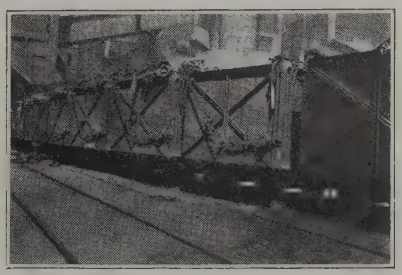


Fig. 3—Steel Dump Cars at D'Ivry Plant, with a Capacity of About 9 Cu. Yd. Each

The engineer in charge informed me that a contract had been entered into with a nearby electric light company to sell them steam at 500 lb.-pressure from boilers installed in the incinerator plant. The contract provided that a given quantity of steam was to be furnished every day in the year, and in order to insure fullfilment of this contract oil burners were installed under the boilers in case the incinerator had to be shut down for any cause. The revenue received from this power was about $25,000 per year which was enough to pay the interest on the investment in the plant. The plant is owned and operated by the city of London.

Paris Served by Four Plants.—Paris, with a population of approximately 3,000,000, is served by four incinerators which have a joint capacity of 143 tons per hour or a total capacity of 3,432 tons per day of 24 hours.

In the collection of refuse, ashes are mixed with the rubbish and garbage in order to obtain the necessary heat for combustion, and in all of the Paris incinerators various by-products are made from the clinker as in England. The plants are all of the high temperature brick type; the original English design having been modified to suit local conditions.

All incinerators in Paris, and I believe most of the public utilities, are operated on a joint ownership plan that is unique and interesting. The city pays for the plant and all improvements while a private company operates the plant and receives its pay from the sale of power, brick and other by-products, reserving for itself a fixed return on the capital invested as well as a fixed amount for overhead and salaries. The balance, if any, is paid to the city. The operating company is allowed to capitalize itself only up to about a 10 per cent basis of the total investment by the city so that payment of dividends on watered stock is avoided.

The writer visited two of the more recently constructed plants in Paris; one at D'Ivry and the other at d'issy Moullineaux. Both plants are enormous in area covering huge blocks and elaborate machinery equipment has been in-

Fig. 4—General View of the Other Parisian Plant, at d'Issy Moullineaux, Showing Entrance from Street, Stack, and Administration Building

stalled both for handling the incoming rubbish as well as the clinker for the manufacture of cement brick.

At d'Ivry the rubbish is delivered in large covered motor trucks which back

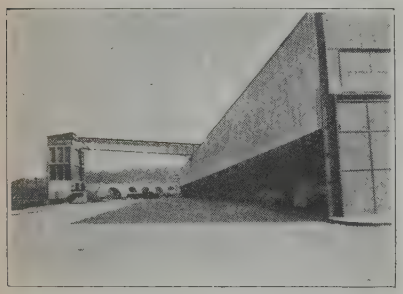


Fig. 5—Entrance for Trucks at d'Issy Plant. Trucks Dump Into Bin Running Full Length of Building, About 450 Ft. in Length. Car Runs Along Back of Bin. The Overhead Belt Conveyor Is Used for Fertilizer

up to a platform and dump into steel cars of about 9 yd. capacity. These cars are rolled into the incinerator; the removable bodies picked up by a crane and the rubbish dumped into a bin

Fig. 6—Car Used in d'Issy Plant for Unloading Rubbish Onto Belt—Moves Along Storage Bin

where it is raked on to a belt conveyer and elevated to the top of the building.

As the belt travels through the building the picking out of bottles, rags, etc., is carefully attended to. The belt feeds the residue into a revolving screen where the dust is screened out of the mixture. This dust is chuted down into an adjacent building where it is bagged and sold as fertilizer. The residue is dropped onto the floors below through chutes and raked onto the brick arches of the furnaces by hand. When it has sufficiently dried it is raked down onto the burning grates. The clinker is pushed out by a hydraulic ram at the front of the furnace where it falls through openings in the floor to cars below.

After the clinker has cooled it is fed into two sets of grinders, then through one set of rolls and finally into the brick making plant. Here it is baked in steam heat for ten hours to get rid of the lime contained in the ash, mixed with cement and put through a brick making machine. The bricks are piled in the open yard and after setting are sold for 200 Francs per 1,000 brick. The price of the common brick in Paris at that time was 300 Francs per 1,000. The power for operating the d'Ivry plant is furnished by steam boilers utilizing the waste heat from the incinerators. The steam is transformed into electricity by means of steam turbines.

On the following day the writer visited the largest and most modern incinerator in Paris, which, as a matter of fact, was not entirely completed in some of its details but which was in full operation, nevertheless. This plant is located at d'Issy Moullineaux and has a capacity of 63 tons per hour. The plant is enormous in extent and contains some 60 high temperature cells, in addition to large drying and storage yards, brick manufacturing plant, high pressure boilers, steam turbines, electric generators, etc. There was no wood or street sweepings in the refuse but the material in general was much dryer than that found in the United States. The refuse is collected in covered trucks and dumped into a long bin running the entire length of the building. Here it is picked up by a traveling crane and dumped onto a movable bin at the bottom of which is a belt conveyer. As soon as the bin is loaded the belt conveyer under the bin is put in motion by its own individual motor and the material fed onto a long movable belt which runs the entire length of the building. The material is elevated through the building to the roof, the belt being picked over on the way for bottles, rags, etc. There the refuse is dumped into revolving screens and the dust chuted to a separate building where it is bagged and sold for fertilizer. The writer was informed, in this connection, that the price obtained from this fertilizer was very low and it was doubtful whether it paid to collect and sell it.

In the course of construction on the top floor of the building were two large cylindrical dryers through which it was proposed to feed the garbage in wet weather. The heat for the dryers was to be furnished by the incinerators.

After leaving the revolving screens the refuse is dropped into bottom dump buckets, which are moved by cable on a monorail on the floor below. From these buckets it is dumped into chutes to the charging floor and there raked by hand into the furnace through charging openings onto the brick drying arch. At intervals the material is raked off onto the burning grates and when the clinker is thoroughly burned the grate is revolved 180 deg. by electric motor which dumps the clinker without opening the doors of the furnace. This revolving grate is made of iron covered with fire clay—is solid without perforations. The hot clinker drops into metal cars which are picked up by a crane, dumped in a cooling yard where the clinker is watered by a hose until cooled off. It is then picked up and run through the crushers and rollers after which it goes to the brick making plant.

In talking with one of the city engineers in charge of incineration, and in reply to a question as to whether the elaborate machinery necessary for making brick paid, he stated that he thought they came out about even and

Fig. 7—Hot Clinker Is Dumped from Overhead Crane Operating on Monorail Grinders and Piles of Ground Clinker Are Also Shown

that it was worth while in an old and densely inhabited district such as Paris as it saved dumping space, that would otherwise be filled with clinker, for other purposes.

The maintenance charge on both of these Paris incinerators is heavy. Not only is the wear and tear on the type of machinery used heavy, but the brick furnaces have to be relined yearly. Very high temperatures are employed in the furnaces and when charges of wet garbage come in contact with the heater fire brick, rapid deterioration ensues.

German Plants.—The first plant inspected was at Frankfort, which has a population of 400,000. This is a large and elaborate plant of a high temperature brick type. I found it was shut down and had been since the close of the war, due to lack of funds for making the necessary repairs. During the four years of the war no repairs were made and the disintegration of this type of furnace is rapid and cumulative unless it is frequently inspected, and repaired when necessary. The furnaces had been removed from the incinerator building and the building itself rented to a manufacturer. Another reason given for shutting down the plant was the general use among householders of a coal substitute in the form of a low grade coal briquette. After the war coal became very expensive and the consumption of low grade coal in the form of briquettes contained few heat units and combustion could not be obtained in the incinerators without the use of coal. The ash from briquettes is also unsuitable for brick making and this is given as another reason for the discontinuation of many incinerators in Germany.

From the writer's observation at the dump where the rubbish is at present being disposed of, both at Frankfort and Weisbaden where the incinerator was also shut down, our American types of incinerators would easily have disposed of this material without the use of fuel.

The Frankfort plant manufactured brick and the waste heat from the incinerators was also used for the drying of screenings from the sewage treatment plant which occupied a portion of the same building. The dried screenings were sold for fertilizer. This is a very interesting feature of this plant and one that should be copied wherever practical in the United States. Screenings are a very difficult material to dispose of, but if they can be dried or mixed with refuse and burned in an incinerator the process is greatly simplified.

Closed trucks are used for the collection of rubbish and these are supplied with a removable cover that exactly fit the collection receptacle left with the householder so that the garbage does not come in contact with the air in the process of dumping into the truck. This is a carefully worked out German idea which is entirely too elaborate for American practice.

The Weisbaden plant was also shut down for the same reasons governing the abandonment of the plant at Frankfort. The furnaces had been removed and the building had been rented to a foundry. At the dump some interesting trucks and trailers were observed. One in particular containing a worm gear which lifted the rubbish to the high part of the truck from the ground level.

The incinerator at Furth, formerly one of the show plants of Germany, was also shut down and the building used for other purposes.

The writer was informed that a new large plant is under construction at Cologne. This is a very elaborate design and considerable revenue is to be obtained by the manufacture of brick from slag.

Another large incinerator plant is in operation at Berlin but this was not inspected.

Plants in Beccari, Italy.—The next plant inspected by the writer was the Beccari plant at Florence. Florence has a population of 250,000 and the garbage and rubbish is handled in this plant of 200 cells. The cells are of concrete, contain about 1,000 cu. ft. of garbage and are furnished with suitable drainage sumps and ventilating cuoplas. The collected material, consisting of rubbish and garbage, is dumped on the floor of an outer shed where the rubbish is picked out. There seemed to be very little rubbish in this material. The garbage is comparatively dry, very different from that produced in America, and probably contains not more than 20 to 25 per cent moisture. It is loaded into the cells by hand, and wet down with the sump liquid that has drained from some of the other cells. The doors of the cells are then closed and the fermentation process begins. After a period of a week or ten days the temperature rises to about 150 deg. F. After a digestive period of from four to five weeks the cycle has been completed, the temperature drops to about 100 deg. F. and the material is removed. The humus as it comes out is a dark brown practically odorless mixture which has high fertilizer value. It is screened and sold for fertilizer, the finer grades at about $7.00 a ton and the coarser ones at from $3.00 to

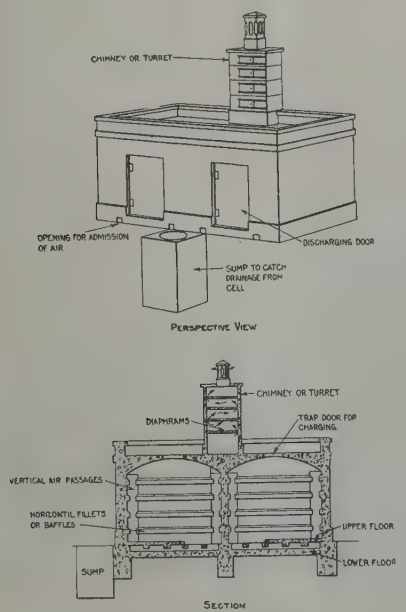


Fig. 12—Drawing Showing Beccari Cell Used in Florence and Scarsdale Plants

Fig. 8—General View of Frankfort Plant

Fig. 9—Collecting in Frankfort Is Done with These Trailers Equipped with Covered Buckets

Fig. 10—Old Type of Collecting Truck at Dump in Weisbaden

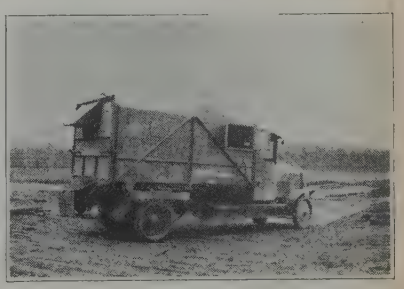


Fig. 11—Another Type of Truck Used in Weisbaden. Rubbish Lifted Into Body by Worm. In Unloading, the Body Tilts 70 Deg.

Fig. 13—A Beccari Plant at San Remo

$4.00 per ton. One or two of the cells have been fixed up with stacks to be used as incinerators and the collected rubbish is burned in these cells. The plant at Florence is operated by private contract, a contractor takes the material at the plant, the collection being done by the city.

The next plant inspected was also a Becarri plant at San Remo which is a small winter resort on the Italian Riviera. This is the latest design of the Becarri Company and differs considerably from the Florence plant in that the cells are somewhat smaller in area and less in height and the ventilating system is entirely different. The cell walls are constructed of hollow tile arranged with proper openings for the free circulation of air into the interior of the cells and it is claimed that this plant is more efficient than the type used in Florence. The plant had just been completed at the time the writer visited it but was not yet in operation.

Fig. 15—Clamshell Dumping Refuse Into the Furnace at the Philadelphia Plant

Becarri Plants in United States.—On the writer's return to this country, he was so impressed with the design of the Becarri cells in San Remo that two

Fig. 14—General View of Heenan Froude Multiple Cell Type Plant at Buffalo

experimental cells were built in Long Island City near out field office where observations were taken during the fermentation of the garbage in these cells. Owing the fact that American garbage contains 85 to 90 per cent moisture, cells 10 ft. high, such as used in Florence are not adaptable to the treatment of this wet material. In the experimental cells horizontal trays are inserted at about 30 in. centers and the garbage placed upon them in layers not exceeding 24 in. in thickness. The cells are built of hollow tile, separated by a ¼ in. opening one from the other. An opening at the front is so arranged that the air can circulate entirely around the cells.

Both cells were filled with garbage, one being treated with about 5 per cent lime mixture and the other without. At the end of 30 days the fermentation process was completed, the material was practically dry and odorless and ready to go to the grinder to be reduced to commercial form, bagged and sold. In the adjacent town of Scarsdale, N. Y., where this process has been in operation for some time this same system of shelves has been installed with similar satisfactory results. The material is ground after remaining four or five weeks in the cell and sold to farmers who come and load it, for $20 to $25 a ton. It is self-evident that if anything approaching the above mentioned prices can be obtained for the ground humus the plant will pay for itself in a very short time. It is necessary to install a small incinerator at each plant to take care of the papers and other rubbish that is collected.

Incinerators in the United States.—A description of a few recent installations of incinerators in the United States will be of interest, showing as it does how much more simple the design becomes when the manufacture of by-products such as cement brick is dispensed with.

The recent 500-ton plant at Buffalo is a Heenan Froude, high temperature multiple cell type. The refuse is dumped from the collection truck into storage bins. Clamshell grab buckets operated by overhead traveling cranes pick up the refuse from the bins and load it into the furnaces as needed. The plant is operated in three shifts of 8 hours each.

A 200-ton Decarie incinerator was built in 1927 in Philadelphia. This plant contains two large storage bins—one on each end of the building—into which the refuse is dumped and from which it is handled by a clamshell bucket and overhead crane into the furnace.

A test at this plant by the city of Philadelphia showed temperatures in the combustion chamber in excess of 1,800 deg. F. with an average of about 1,500 deg. during the test period.

In the city of Providence, R. I., a 160-ton Decarie plant was built in 1927 which contains one novel feature in the

Fig. 16—General View of Philadelphia Decarie Plant

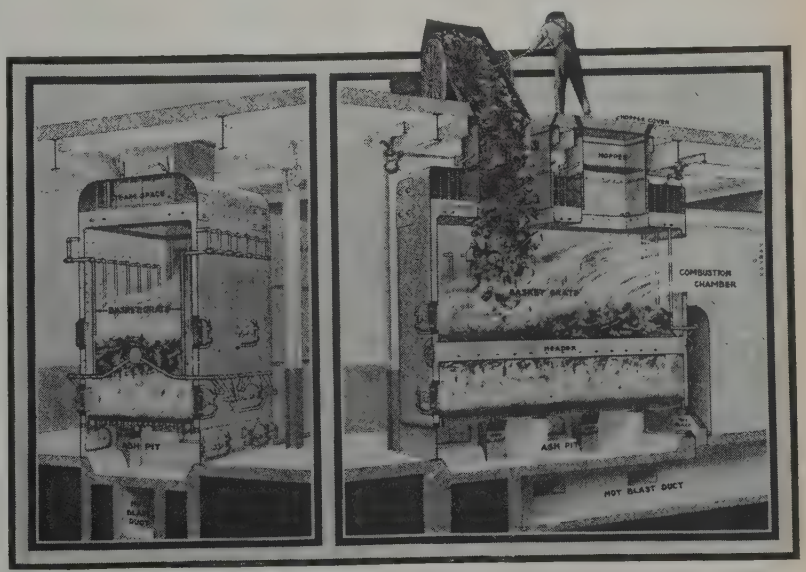


Fig. 17—Drawings Showing the Design of the Decarie Water Jacketed Furnace

Fig. 18—Unloading Containers from Trucks at Providence Plant

handling of the refuse. Removable steel containers are used on the collection trucks which are handled directly from the truck by an overhead crane into the furnace. During the collection period the excess containers are stored on the charging floor of the incinerator and dumped into the furnace as required on the succeeding shafts. By this method the rubbish and garbage is not moved from the original container in which it has been collected until it goes into the furnace and is, therefore, one of the most sanitary methods of collection that has been devised.

The Decarie furnace is of steel water-jacketed construction. It also contains a tubular water-jacketed basket into which the rubbish is dumped and from which it is raked onto the second burning grate below. The production of steam in this furnace is approximately 1 lb. of steam per pound of refuse burned.

The American engineer in studying the problem in his own country might well copy the economics effected in European practice through the utilization of the waste heat now escaping through our chimneys at temperature around 1,000° F.

The tendency in American incinerator practice today is for larger units, crane fed with 24 hour operation. This mechanical equipment requires considerable power to operate it and by the installation of steam boilers and electric generators, a large saving can usually be effected. Combustible refuse is plentiful in most American cities. The result is high furnace temperatures and the loss of quantities of energy that can economically be put to use in the operation of the incinerator plant.

Quite recently the secifications of a 225-ton capacity crane operated incinerator contained a guarantee clause

Fig. 20—General View of Providence Decarie Plant

stating that the consumption of electric current for plant operation would not exceed 3.37 kilowatts per ton of capacity. Electric current costs 3½ ct. per k. w. in this city so that the yearly bill for power will be $8,200. This amount capitalized at 4½ per cent equals $182,000. As the cost of the power equipment to operate this plant would only cost a fraction of this amount a considerable saving could be effected by its installation.

Acknowledgment.—The foregoing is a paper printed at the 58th annual meeting of the American Society of Civil Engineers.

Paved Street Maintenance at Los Angeles, Calif.

The repairing and resurfacing of asphalt, macadam and other bituminous pavements in Los Angeles and the replacement over excavations made by utility companies is handled by the Maintenance Division of the Engineering Department of the city. The following details of the work during the fiscal year ended June 30, 1927, is taken from the annual report of the Engineering Department of which John C. Shaw is City Engineer.

Several methods are used in the maintenance of paved streets: The surface heater process, resurfacing by cover process and by the patch process.

The surface heater process is to heat the surface and remove part of old surface so that new material may be added; the average mixture which is added is 1¼ in. This method has been employed since 1917 and many of the main thoroughfares have been resurfaced, causing very little inconvenience to the traveling public.

The cover process is used mostly on the highways and streets where it is not necessary to remove any of the old surface and where the cross section of the old streets will stand added material; this process is to clean the streets, apply liquid asphalt as a binder and rake and roll new mixture over old surface. This method has been used for the past 14 years and has been very satisfactory.

The patch process used is to cut out the worn-out places where the base has failed.

The personnel of this division during the past year consisted of 1 superintendent, 1 assistant, 1 truck dispatcher, 9 foremen, 9 engineers, 1 watchman, 20 asphalt workers, 8 heater workers, 45 laborers, 8 city-owned trucks, and 21 contract trucks. These are divided into 9 gangs, 1 heater crew, 6 re-surfacing crews, 2 small crews on special work and patching, and 1 crew is used in pouring cracks in concrete pavements. Notwithstanding the added territory and additional work this division is called upon to do, less personnel was allowed than during the previous year.

The materials used by the street replacing divisions during the current year, which were produced by the two Municipal asphalt plants, was 98,988 tons of various asphalt mixtures and 16,090 tons were purchased from private plants.

The following table indicates the area of each class of work placed and the cost per sq. ft.:

The street replacing division records show that 1,583 jobs were outstanding at the close of the last fiscal year, which were all completed during the early part of the year. The number of work orders received during the current year was 64,462, of which 62,327 have been executed, making, in conjunction with the orders outstanding at the first of the year, 64,841 work orders executed during the current year and 2,135 not yet completed. The average daily number of jobs completed was 224.

Below is given a tabulation of the area of each class of surface replaced during the year, followed with the cost per unit. The data given is exclusive of those for San Pedro, Wilmington and the San Fernando Valley:

The charges for all work performed are made at the following rates:

The working force of this division during the current year, has consisted of 1 superintendent, 3 clerks caring for the work in the office, 2 foremen in charge of the asphalt and concrete work, who at present are responsible for 2 asphalt foremen, 1 roller engineer, 11 asphalt workers, 73 laborers, 3 city-owned 2-ton trucks, two of which are used for emergency patch work, and 19 5-ton contract trucks.

	Area Sq. Ft.	Cost Per Sq. Ft.
Resurfacing with surface heaters	3,062,284	$.0564
Patch repair work	716,449	.1118
Cover repair work	1,441,528	.0665
Resurfacing by cover process	2,282,750	.0477
Reconstruction of paved areas	311,902	.0744

	Per Sq. Ft.
Replacing asphalt pavement base and surface	$ .40
Replacing macadam pavement	.30
Replacing brick pavement	.40
Replacing granite block	.30
Replacing oil gravel	.12
Replacing streets not oil graveled or paved	.01
Replacing sidewalks	.28
Replacing concrete street pavement	.30
Replacing curb, per lin. ft.	.50
Replacing asphalt only	.18
Replacing concrete only	.22
Replacing prospect holes, each	.15
Replacing stake holes, each	1.00

Class of Service	Area Sq. Ft.	Cost Per Sq. Ft.
Asphalt paved streets	482,902	$ .3816
Macadam	23,773	.2871
Brick	3,148	.8111
Concrete	127,319	.4377
Sidewalk	42,816	.3544
Curb, lin. ft.	314	1.08
Granite block	3,200	.6418
Asphalt only	7,356	.2136
Oiled gravel	1,180,205	.0944
Dirt streets	1,430,090	.0006

Tax Increase in Massachusetts Town

The tax rate for Westfield, Mass., for this year was formally announced on Sept. 3 as $33 on each $1,000 of assessed valuation, an increase of $1 over the rate last year. The 1927 rate was an increase of $1 over that of the previous year.

A $300,000 bond order for a new high school is involved.

Unusual expenditures this year are in the main responsible for the increase, there being $31,000 appropriated for repairs and alterations to the present high school plant and $20,000 for the construction of a concrete bridge at Little River to replace a structure which collapsed last Fall. The valuation of the city was increased nearly $500,000. Reductions in other taxes made it possible to keep the rate at the figure reached.

City Planning and Zoning

The U. S. Bureau of Standards has received from the printer the "Standard City Planning Enabling Act," Building and Housing Publication No. 11. This act was drafted by the Advisory Committee on City Planning and Zoning in response to many requests for a standard act which might be used by the various States in enacting city planning legislation. It covers the four general subjects which experience has shown to be a necessary part of planning legislation; namely (1) the making of the city plan and the organization and powers of the city planning commission, (2) the control of subdivisions, (3) the control of buildings in mapped streets, and (4) regional plan and planning commissions. Copies of this publication may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 ct. each.

How Rock Asphalt Tennis Courts Were Constructed at Shelby Park, Louisville, Ky.

By WM. CALVERT
Engineer in Charge of Construction

Tennis courts with rock asphalt surfaces have been constructed recently at Shelby Park, Louisville, Ky. The base was built of limestone rock laid in two courses and each course thoroughly choked with screenings and rolled until a stone laid in front of the roller was crushed instead of being rolled into the base.

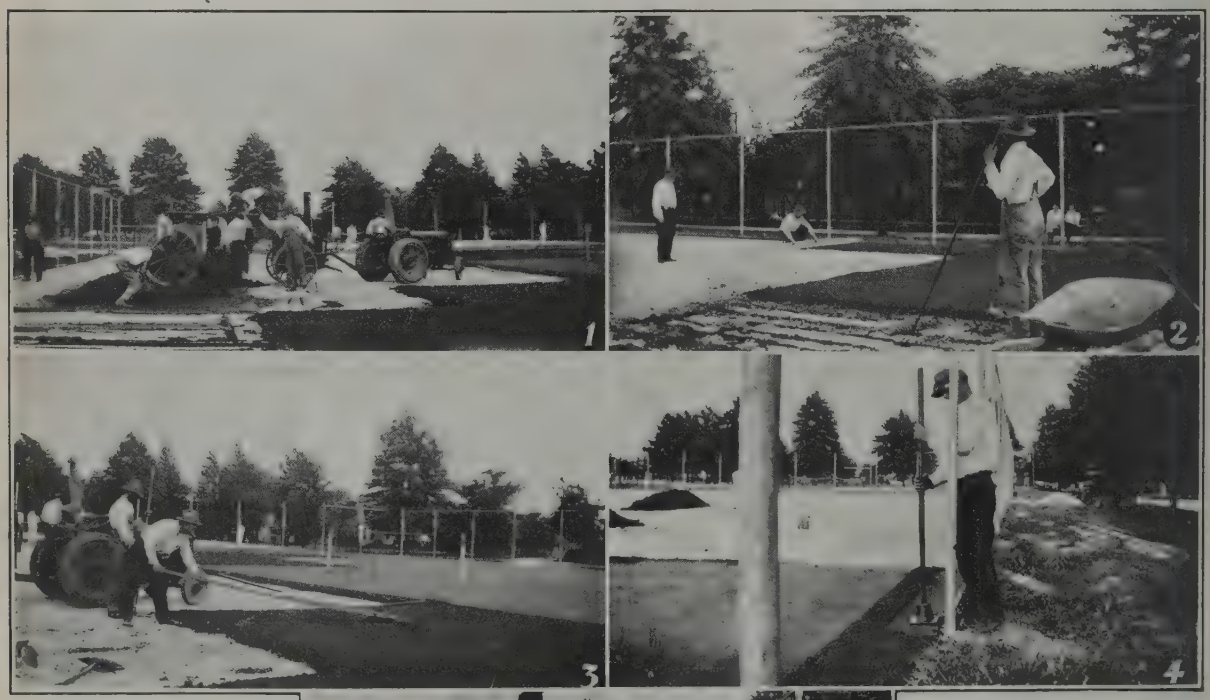
After the courts had been laid out with grade stakes for the loose thickness of the rock asphalt, irregularities were sought in the base and corrected. Replaced rock was again screened and rolled. The courts had two broomings, two rollings, before they were pronounced ready for the rock asphalt.

The Kyrock was dumped from Fordson tractor trucks on to boards laid on the rock base. Shovels were used to spread it and large tine rakes were used to smooth it off.

A straight edge was used to level two sides of each section to the true grade and a 6 ft. wooden lute was used to make the center correspond to the sides.

At the end of each day the loose Kyrock was rolled. A concrete hand tamp was used to tamp the edges of the court and around the net posts. After the whole area had been rolled once, the roller was run the opposite direction to roll out any waves which had shown up from the previous rolling.

A straight edge was laid in all directions in each section to find depressions and they were filled with Kyrock sifted in a ¼ in. sieve, also any of the surface that was honeycombed was corrected the same way. This was then rolled and then the whole court was given its final rolling.



(1) How the Rock Asphalt Was Conveyed from Cars and How It Was Dumped on the Boards

(2) Using the Straight Edge to True the Edges

(3) Wooden Lute Used to True the Surface

(4) The 12 in. x 12 in. Concrete Hand Tamp Used Around Net Post and Edges of Court

(5) Close-Up of First Rollin

Constructing Tennis Court at Shelby Park, Louisville, Ky., with Rock Asphalt Surface

Water Softening Plant at Marion, Ohio

Paper Read Before the Central States Section of the American Water Works Association

By GEORGE WHYSALL
Vice-President and General Manager, The Marion Water Co., Marion, Ohio

I HAVE been asked upon numerous occasions why an attempt had been made at Marion to soften water supplied by wells and having a total hardness of from 40 to 51 grains per gallon, and if consideration had not first been given to another source of supply.

In the first place, a considerable sum of money had already been expended in the drilling and equipping of wells with the object of securing an ample supply of water from the limestone underlying the greater part of the district surrounding Marion. This water is and always has been of an exceptional character and no trace of typhoid has ever been found to have originated from the use of limestone water furnished by The Marion Water Company. Second, there is not available to the plant a river supply sufficient to take care of the requirements, about 2½ to 3 M. G. D.

Storage.—The softening plant as designed, contemplates a detention period long enough to drop out the maximum quantity of silt which is carried by a stream about three miles distant from the plant, the latter having a normal flow greater than the Marion requirements for some time to come.

As the plan worked out, we have two million gallons in the two basins and two million gallons in each of the two large tanks, so that there is available practically six million gallons, plus the combined capacity of the deep well pumps, four million gallons daily.

Variable Hardness.—A two years study was made of the different wells with the result that there was found a surprising difference in the water produced, and the next discovery was that wells after several days shut-down, produced a much harder water than when in continuous operation. This peculiar condition continues and no satisfactory reason for the irregular hardness of the water has been had.

We find that some wells are more consistent than others in that they produce a uniformly softer water than others. Consequently we have had to develop a schedule for well operation, bringing into service, first, those producing the softest water, and as the demand on the plant increases, the next hardest wells are, in turn, brought into operation.

Lime-Soda Treatment.—In the selection of the proper type of softening plant, it is essential to determine the ratio of carbonates of lime and magnesia to the sulphate hardness, which in our case is about 50 per cent. It was, therefore, concluded that the so-called lime-soda process should be adopted with provisions made for the future installation of green sand (Zeolite) filters for the purpose of eliminating the soda ash treatment and the substitution of the green sand, salt regeneration method. Estimates have been prepared covering this substitution treatment which indicate some saving, water could then be delivered at zero hardness, or by remixing, at any total hardness desired.

Basis of Design.—We determined, before making the preliminary plan, to call in, for consultation, a widely known chemical engineer (Charles P. Hoover), one who was already familiar with some of our problems. The chemical end of the problem being worked out, it then became a matter of determining the capacity of the plant, 5,000,000 gal. daily, and the sequence of the several parts making up the unit. The chemical house was first designed and instead of housing the two chemical storage tanks and supporting them on the walls of the building, we made the supports independent of the building and on their own foundations. These storage tanks are 16 ft. in diameter and 30 ft. high and will hold 215 tons each. They are closed over tightly at the top and project throughout their entire length above the roof of the chemical house. The bottom ends of these tanks are funnel shaped, provided with a hand operated slide gate which permits the material to be dropped directly into the weigh hoppers beneath. The tops of the weigh hoppers and the bottom of the tanks are connected with a muslin skirt or tube, which prevents the dust of the materials from escaping into the room.

Feeders and Slakers.—Immediately under the weigh hoppers are the Browning feeders and slakers. The feeders and slakers are motor-driven and are supplied with water to an extent which does not permit any increase of temperature through the slaking of the lime. The lime and soda ash solution are removed from the slakers and forced into the mixing tank by means of a water ejector.

Mixing Tanks.—The mixing tanks are 30 ft. in diameter, 30 ft. 8 in. high and are so arranged that they may be operated in a series or parallel. The water enters the mixing tanks on a tangent, thereby assisting the stirring mechanism to a considerable extent in the movement of the water. The stirring mechanism consists of paddles attached to the lower end of the vertical shaft and are set to operate quite close to the bottom. The weight of the vertical shaft and the driving mechanism is supported on ball bearings attached to a bridge extending across the top of the tanks. This bridge also carries the reduction gear and variable speed motors. There is but slight difference in velocity between the movement near the center and circumference of the tanks and speed of mixing is adjustable.

Dip Pipe Feed.—Originally the lime solution was to be introduced through a nozzle on the tangental feed pipes. This method has been abandoned on account of the coating and clogging of the nozzle, which was 2½ in. in diameter, and the substitution therefor of a 6-in. dip pipe which carries the lime solution over the top of the tank and down to a point in the zone of the feed pipe discharge. The soda ash solution is discharged through a dip pipe extending down about half way in the mixing tank. We have introduced the soda ash solution at different points in both mixing tanks, but practice indicates that both the lime and soda ash solutions should be introduced in the first tank, the latter at a point far enough above the lime to permit the lime reaction to become complete before the soda ash makes contact. This tends toward more uniform effluent of the second tank as well as a better floc. As an experiment, we tried the introduction of a very small alum dosage introducing same into the mixing tank with the soda solution. This had a tendency to thicken the floc, but later we discovered a much better point for the introduction of the alum solution, .20 to .25 grains per gallon.

Effluent.—The effluent from the second mixing tank is carried through a 48-in. off-take which is supported from the bridge carrying the Dorr thickener or clarifier, and delivers the effluent into the feed-well of the clarifier tank. This feed-well is also supported from the bridge, is 30 ft. in diameter and extends from above the surface of the water to a point within 10 ft. of the bottom. Due to the extreme low velocity of the water on its way from the mixing tanks to the clarifier feed-well, a distance of 60 ft., the floc is fairly well settled toward the bottom of the off-take pipe by the time it reaches the feed-well. The turbidity in fact is 2 parts per million.

Launder.—Around the circumference of the clarifying tank is a trough or

launder 4 ft. deep and 3 ft. wide. Its inner wall being a few inches below the level of the top edger of the tank, the water overflows into the trough and is carried around in both directions to a point opposite the settling tank, which tank is equipped with a trough or launder similar to the one in the clarifying tank. Having gotten rid of the floc in the first tank, rough treatment of the effluent is immaterial, and for that reason, the settling tank is 1 ft. lower than the clarifying tank. From the launder of the clarifying tank, the water is carried through an offtake to the feed-well of the settling tank. From here, as in the clarifying tank, the water spreads across the bottom with no observable velocity, rises and overflows into a trough or launder and discharges into the carbonating tank, through a dip pipe extending to within 4 ft. of the bottom. From this point, the water rises and passes out through an overflow to the soft water basin.

Carbonation.—It was decided to try carbonating in the feed-well of the settling tank, expecting, by this method, to give the fine suspended calcium carbonate ample time to settle. The results were very gratifying in that we found we could not only reach lower alkalinities but could easily control the turbidity by adding 2/10 grains per gallon of sulphate of alumina.

The effluent from our settling basin now averages ½ part per million turbidity where it previously ran as high as 10 to 15 parts per million.

By careful operation of our carbonating system, we are able to reduce the total alkalinity from an average of 55 to about 35 in the settling tank.

Additional carbonating in the original carbonating tank brings the alkalinity down to an average of 30 parts per million and by the exercise of the greatest care we can reach 23 to 25 parts per million.

Analysis of Water.—An analysis of the water at the various points throughout the system on a representative day, shows the following:

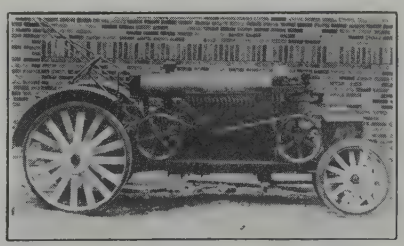
Raw Water	Carbonates	300
	Non-carbonates	400
	Total	700
Mixing Tank Effluent	Total alkalinity	55
	Phenol. alk.	40
	Caustic	25
	Non-carbonates	150
	Total	205
Clarifier	Total alkalinity	55
	Phenol. alk.	16
	Caustic	25
	Non-carbonates	150
	Total	205
Settling Tank (After first carbonation)	Total alkalinity	35
	Phenol. alk.	16
	Caustic	0
	Non-carbonates	150
	Total	185
Carbonation Tank (After second carbonation)	Total alkalinity	30
	Phenol. alk.	4
	Caustic	0
	Non-carbonates	150
	Total	180

Chemical Handling.—An interesting part of the layout is the method of unloading the lime and soda ash, received in bulk carload lots, from which it is elevated by an "Airveyor," which is a vacuum method of elevating the material into the storage tanks by means of vacuum of from 6 in. to 9 in., the air and material being separated in a filter located on the top of the storage tanks.

New Self-Propelling Air Compressor

A self-propelling 4-wheel air compressor, capable of handling heavy loads behind itself and move about on the job under its own power, has been brought out by the Pontiac Tractor Co., Pontiac, Mich.

The compressor is a Quincy Type W-4 of 124 cu. ft. displacement, having a separate radiator with pump driven circulation. This holds the temperature of the air coming from the compressor 60 to 70° below the temperature of com-

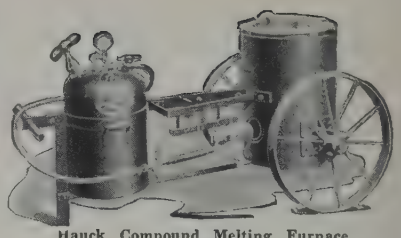


New Air Compressor Outfit

pressors which are cooled from the motive-power radiator. The compressor has a 3-bearing crankshaft and force feed lubrication. This unit is controlled by a Penn unloader with hand unloader attachment. The compressor with air tank and tool box are mounted on a frame which attaches to either the McCormick-Deering or Fordson Tractors. Power is taken from the tractor to drive the compressor through the power take-off pulley, which has a clutch allowing it to be thrown out or into gear at will. The "ahead" drive of the belt brings the belt tightener into the correct relation with the belt.

New Compound Melting Furnace

To keep sewer joint and lead compounds hot, and therefore easily appliable for tight joints, a kerosene compound melting furnace on wheels, has been added to the line of oil burning lead and compound melting furnaces of the Hauck Manufacturing Co., Brooklyn, N. Y. This furnace has been especially designed for melting "G-K Sewer Joint Compound"—"Lead-Hydrotite"—"Leadite" and other compounds. A cast iron pot is furnished as steel pots cause excessive carbonization of material; it is of 120 lb. compound capacity or



Hauck Compound Melting Furnace

about eight gallons liquid. It takes but five minutes to put furnace in operation. The burner is stated to consume about 1 gal. of kerosene per hour; it's on a "slide-rail" so that the heat under the pot can be fully controlled by putting it close up to the furnace for full heat, or move it away for less heat under the pot. The 12 gal. tank is of pressed steel construction (not a welded tank) so that furnace can be operated for 12 hours steadily with one filling. Furnace is constructed of heavy sheet steel; 24 in. roller bearing wheels 2½ in. face.

Cites Benefits of Public Health Surveys

Dr. M. P. Horwood, assistant professor of biology and public health at the Massachusetts Institute of Technology, told those attending the Second Public Health Institute at the Massachusetts Institute of Technology, Boston, recently, of the benefits of public health surveys.

Among the things a public health survey does, he said, is to present a clear picture of the health situation, how to spend money for health work more wisely, serves educational purposes and brings about the addition of needed assistance.

Speaking on city health appraisal forms, Dr. F. H. Walker, of the American Child Health Association, New York, brought out that a recent study made of 186 cities showed that only six of those examined did not have a good water supply. Two weeks in a camp for children during the summer for the treatment of tuberculosis is not enough, he said, pointing out that the effect is not lasting. At least six weeks are needed, he said.

Major Highway Plan for Lucas County, O.—The report of Harlan Bartholomew and Associates for the Lucas County (O.) Planning Commission proposes three types of highways for the county:

(1) Superhighways—width of right-of way, 170 ft.

(2) Primary highways — width of right-of-way, 140 ft.

(3) Major county roads—width of right-of-way, 80-120 ft.

Device for Determining Turbidities in Water

Low Reading Turbidimeter Used at St. Louis, Mo.

An interesting arrangement for the determination of turbidities is employed at the Chain of Rocks filter plant of St. Louis, Mo.

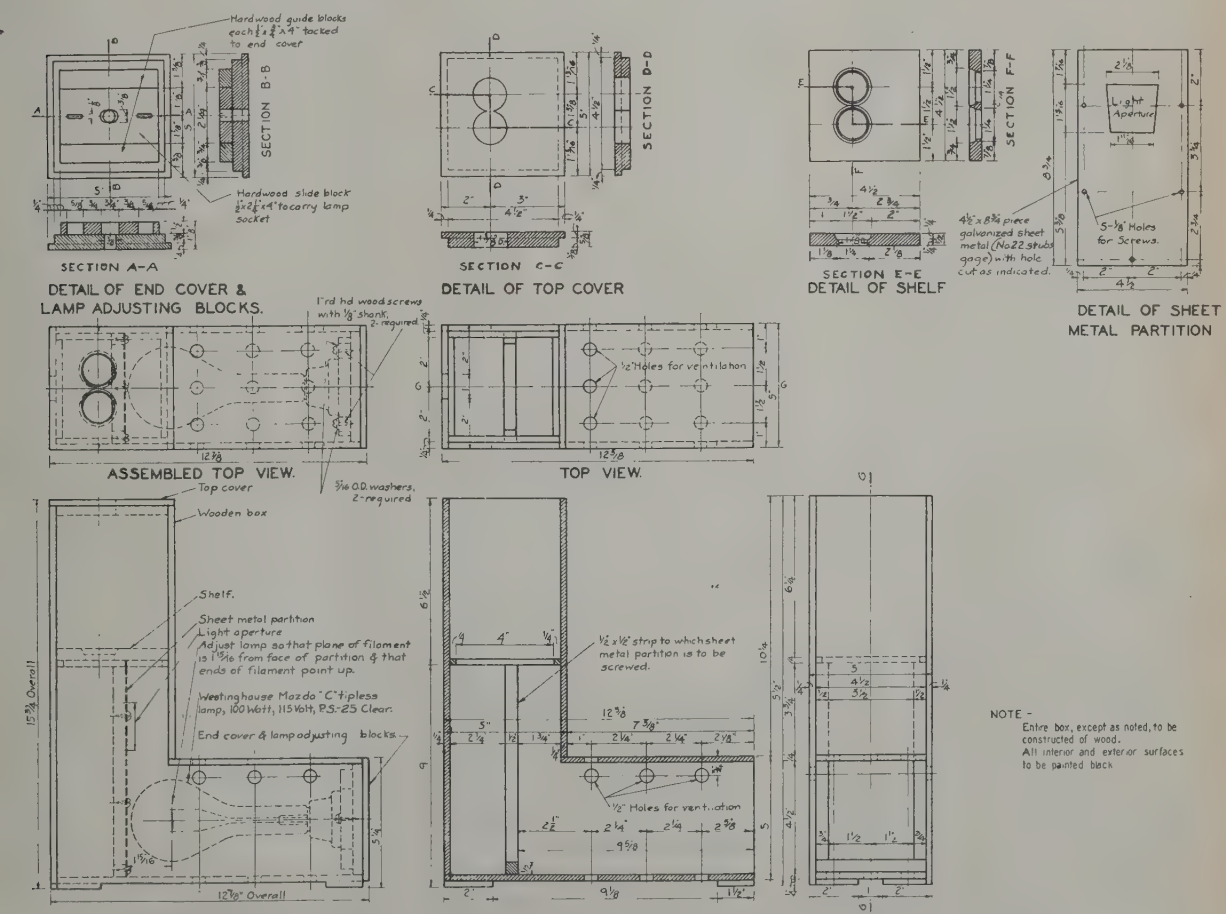
Description of Box.—The entire box, except the partition is constructed of wood and is painted black, both inside and outside. The partition is of galvanized sheet metal, also painted black. All inside dimensions of the box and parts should be made exactly as indicated because the dimensions locating the normal position of the light filament the light aperture in the partition and the circular openings in the shelf are important.

The position of the light aperture in the partition and the openings in the shelf are fixed but the position of the light filament is adjustable. This was made so in order to take care of slight variations in the shape and position of the filament in the lamp. The filament may be moved closer to or farther away from the partition by adjusting the metal contact in the light socket. The filament may be shifted from side to side by means of the sliding block which carries the lamp socket. The position of the filament from top to bottom is fixed: the open end of the filament should point up. The position of the filament need be fixed only once for each lamp.

Ventilation is provided by means of the circular openings in the box but the lamp should be lighted only when the box is in use.

Preparation of Standards.—The glass tubes to be used for making the turbidity determinations should be clear glass 100 cubic centimeter, short form Nessler tubes free from scratches or other imperfections. These tubes should be scrupulously clean at all times. Fresh standards should be prepared each day from a stock suspension, the turbidity of which should be 10 parts per million, so that when one cubic centimeter of the suspension is made up to 100 cubic centimeters with turbidity free distilled water a standard containing 0.1 part per million will be obtained. The suspension containing 10 parts per million can be made from a suspension containing enough turbidity to be determined by the Jackson candle turbidimeter and diluted to yield the desired standard stock suspension. The standards to prepare will depend upon the turbidity of the water being tested. Experience will soon enable the observer to reduce the number of standards required to a minimum.

Introduce 100 cubic centimeters of the sample in one of the tubes and set it into one of the holes in the shelf. After all air bubbles have risen to the surface, the sample is ready for comparison with the standards. If the sample is a filtered water of low turbidity, the standard of 0.5 part per million may be prepared and set in the other hole in the shelf and after all air bubbles have disappeared, the comparison may be


Hardwood guide blocks each ⅞ x ⅞ x 4" tacked to end cover
SECTION B-B
Hardwood slide block ⅝ x 2⅝ x 4" to carry lamp socket
SECTION A-A
DETAIL OF END COVER & LAMP ADJUSTING BLOCKS.
SECTION C-C
DETAIL OF TOP COVER
SECTION D-D
SECTION E-E
DETAIL OF SHELF
SECTION F-F
Light Aperture
4½ x 8¾ piece galvanized sheet metal (No 22 sheet gage) with hole cut as indicated.
5-⅛" Holes for Screws.
DETAIL OF SHEET METAL PARTITION
1" rd hd wood screws with ⅛" shank, 2 required
ASSEMBLED TOP VIEW.
½" Holes for ventilation
TOP VIEW.
Top cover
Wooden box
Shelf.
Sheet metal partition
Light aperture
Adjust lamp so that plane of filament is 1 15/16 from face of partition & that ends of filament point up.
Westinghouse Mazda "C" tipless lamp, 100 Watt, 115 Volt, P.S.-25 Clear.
End cover & lamp adjusting blocks
⅜" O.D. washers, 2 required
ASSEMBLED SIDE ELEVATION
½" x ½" strip to which sheet metal partition is to be screwed.
½" Holes for ventilation
SECTION G-G
END VIEW
NOTE -
Entire box, except as noted, to be constructed of wood.
All interior and exterior surfaces to be painted black

Details of Turbidimeter Designed and Used at the Chain of Rocks Filtration Plant, St. Louis, Mo.

made. If the turbidity of the sample is less than 0.5, estimate and prepare a weaker standard. If greater, prepare a standard of higher turbidity.

The principle involved in the determination of turbidities in this box is the observation, against a dark background, of the suspended particles in the sample of liquid illuminated by admitting light rays at an angle, through the bottom of a glass tube which is contained in a dark chamber.

Turbidities ranging from 0 to 15 parts per million may be determined.

This box was designed by the laboratory staff of the Chain of Rocks Plant and was built by the department's carpenters.

Inspection and Maintenance of Filter Beds

By J. M. JESTER
Engineering Assistant, Washington Suburban Sanitary District, Hyattsville, Md.

In order to obtain the best and most satisfactory results from the filters at the several water filtration plants in the Washington Suburban Sanitary District it is necessary to inspect the filter beds at regular and frequent intervals. The expense attached to these inspections is slight as compared to the possible loss of a filter or two due to improper functioning at a time when most needed.

Satisfactory effluents may be obtained from filters having several blown strainers if the raw water turbidity is low at this time, but with high turbidities good effluents are difficult or perhaps impossible to secure. The effluents may be in such a condition as to make it necessary to place these filters out of service, and if the plant is operating at full or nearly full capacity, the remaining filters will have to be overloaded at a time when they should be run at rates as low as possible. The overloading of these remaining filters may mean still further trouble in obtaining satisfactory effluents as long as the high turbidities prevail. It is more than likely the trouble experienced could have been avoided if regular and frequent inspections had been made.

Procedure in Inspecting Filters.—In inspecting filter beds I find the following procedure gives good results. The filter is first washed in the usual way. The influent valve is shut off and the filter bed drained. The sand depth is checked to ascertain whether or not sand is being lost from the bed. A loss of sand would indicate too high a rate of wash water or trouble in the underdrains. The surface of the bed is next examined for mud balls, mud cracks, or funnel-shaped craters. The presence of mud balls indicates improper washing probably caused by a low rate or too short a period of washing. Mud cracks, if found, indicate clogged underdrains. This should be given immediate attention because of overloading of the remainder of the bed to obtain normal rates. Craters also indicate trouble with the underdrains, probably a blown strainer or two. A filter found to have blown strainers should be put out of service immediately and be kept out until proper repairs can be made, in order to prevent loss of sand from the bed, the passage of improperly filtered water, or both. To replace a blown strainer, only a section of 5 or 6 ft. of the bed surrounding the crater need be removed. Where high pressure wash water is used strainers may be blown by opening the wash water valve too quickly. If the strainers continue to blow in various sections of the filter with normal washings, it is advisable to give the underdrain system a complete overhauling as the laterals probably are in bad condition.

The filters at our plants are equipped with sight bottles attached to each of the effluent lines. These bottles are located on the operating floor beside the filter. They show, at a glance, the condition of each effluent. Should a strainer be blown or lateral bursted during the washing of the bed, sand will begin to collect in the sight bottles immediately after the filter is placed back into operation. In this way we have been able to detect blown strainers and take the filter out of operation before much sand has been lost from the bed.

Examination of Sand.—The sand is examined for mud after the surface of the filter has been inspected. This is done by rubbing between the hands a small amount of sand taken from various points on the bed. If mud appears on the hands from each point examined it indicates that too low a rate of wash is being used. Should the mud appear only at several points it would indicate clogged underdrains. Clogged underdrains must be given attention as soon as possible. I have found that a larger and larger area becomes dead if a filter having clogged underdrains is left in operation. This results in a rapid loss in the rate of filtration and more frequent washing. The remainder of the filter, being relatively clean, is overloaded in an endeavor to maintain the desired output. Clogged filter sand may be located, also, by thrusting a hoe down into the bed during washing. It is difficult to get the hoe down in the clogged areas as the sand does not come up in suspension.

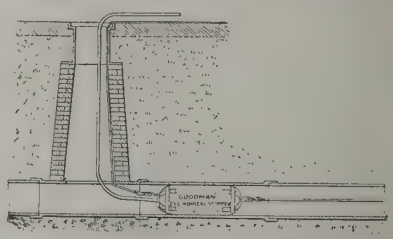
The next step is to take a hoe or shovel and dig into the sand at several points on the bed to determine whether or not there is any gravel in the sand. Should gravel be found in the sand, either the wash-water rate is too high and should be decreased, or the gravel at the bottom of the bed is of insufficient size to spread the wash-water properly.

The holes dug in the bed are finally filled and the surface of the sand leveled off with a rake. The filter is now washed, the surface being watched closely to note whether or not the appearance of the wash-water is uniform over the entire surface of the bed. The wash-water rate is checked by measuring the vertical rise of the water, and a beaker full of the water is caught and examined for sand. After completing the washing process the filter is ready to be placed into service again, if found in proper condition.

Acknowledgment.—The above article is taken from the Proceedings of the (1928) Second Annual Conference of the Maryland Water and Sewerage Association.

Handy Device in Stopping Flow in Sewers

A useful device for stopping the flow in a sewer while repairs on other work is under way is an inflatable bag with a rugged water proofed casing. This is folded and run down into the sewer and then inflated, thus shutting off the flow at the point of flow. It is stated that thus not only does the broad contact surface insure against the stopper slipping in the pipe, say the manufacturers, but stiffeners inserted in the bag insure straightening out in the sewer as inflation progresses.



Stopping Flow in Sewer with Goodman Cylindrical Stopper

This device, which is made by the Safety Gas Main Stopper Co., 523 Atlantic Ave., Brooklyn, N. Y., also is used in repairing and altering water mains and setting hydrants. When so used this stopper is said to be sufficient to resist pressure under the head required to supply a second story. It provides a dry main so that the men may do their work under the best conditions without resorting to pumping. When necessary, an extra length of tubing can be attached to the stopper.

Cities Regulate Radio Interference.—Several cities have taken the initiative and have passed radio interference ordinances. Zanesville, O., took this step nearly three years ago. Other cities which have such legislation are Oshkosh and North Fond Du Lac, Wis.; Norton and Russell, Kan.; Portland, Ore.; Bay City, Mich.; Fairfield, Ia. The Denver, Colo., council discussed the matter a few months ago, but no ordinance was passed.

The Activated Sludge Plant at Grand Canyon National Park, Arizona

Effluent Used for Industrial Purposes

By JANE H. RIDER
Sanitary Engineer, University of Arizona, Tucson, Ariz.

THE sewage treatment plant at Grand Canyon, Arizona, has an unusual duty to perform. It must not only dispose of the sewage in such a manner that the resulting effluent will not be a menace to the health of the community, but the purification must be sufficient to permit this effluent to be used for industrial purposes.

No water supply is available on the south rim of the canyon. All the water used is hauled for 100 miles from Flagstaff or 122 miles from Puro in 10,000-gal. tank cars, making the cost $3.09 per 1,000 gal. delivered at Grand Canyon. Water must be provided for a permanent population of 400, and the 134,053 tourists who visit the Park each year. Two hotels, a tourist camp, a stable with 150 mules, a 1,282 h. p. steam power plant, a laundry and an ice plant, are maintained to care for these tourists. Lawns and gardens must be irrigated, and water furnished for the boilers of the many locomotives used on the Grand Canyon branch of the Santa Fe Ry. The present water consumption is from 50,000 to 110,000 gal. of clear water per day, and approximately 72,700 gal. of reclaimed sewage.

The Old Septic Tank.—In 1913, in an effort to conserve this expensive water, it was decided to filter the effluent from the old plant and use this reclaimed sewage for the boilers and irrigation. The old plant, consisted of a 3-compartment septic tank, with two 4-compartment filters filled with crushed rock, and a specially designed sand filter which was constructed in the railway shops at San Bernardino. The effluent from this plant was satisfactory for industrial purposes until the number of visitors to Grand Canyon began to increase rapidly, when the old plant became so overloaded that it was necessary at times to by-pass the sewage. The odor from the septic tanks became very offensive, the effluent caused foaming in the boilers, and in 1925 it became necessary to construct a larger plant.

The New Activated Sludge Plant.—Considering all local conditions and the degree of purification required, it was decided that an activated sludge plant would be the most effective installation. The sewerage system and plant were designed by H. B. Hommon, Sanitary Engineer in Charge, U. S. P. H. S., and M. R. Tillotson, then Park Engineer, and constructed jointly by the National Park Service and the Santa Fe Railway. The National Park Service paid $71,992 of the total cost and the Santa Fe approximately $25,000. A definite quantity of reclaimed sewage is allotted to the government and railroad for their respective uses.

The plant consists of bar screens, a presettling tank, diversion box and mixing channel, two aeration tanks, a slow settling tank, with mechanical clarifier, two rapid sand filters, a clear well, chlorinator, and pumps for the return sludge and reclaimed sewage.

The estimates for the volume of sewage were obtained by examining the freight records of the Santa Fe Railway for a period of years to find the number of cars of water which had been hauled to Grand Canyon. Graphs were made representing the actual water consumption and consequent estimated sewage flow. These were extended to 1940. The plant was designed for a capacity of 200,000 gal. per day with a 6-hour aeration period or 300,000 gal. with a 4-hour period. At present they are treating an average of 76,250 gal. per day.

The Sewer System.—The sewer system has a 10 in. vitrified, salt glazed clay pipe for the volt-fall line. A 6 in. vitrified pipe laid in the same trench was provided for the laundry waste water. The concrete manholes were constructed with double compartments, the sewage flowing through one side and the laundry waste the other. The laundry waste line bypasses the plant, as it was thought that the soap, soda and other chemicals used in the laundry could not be treated by the activated sludge process sufficiently to make it suitable for use in the boilers. The waste line below the plant is 8 in. vitrified clay pipe, both laundry waste and excess sludge flow through this line, which empties on the ground at the head of a ravine about 3.5 miles southwest of the plant. The piping is arranged so that in case of emergency the raw sewage will by-pass the plant and flow through the waste line directly to the disposal ground.

Details of the Plant.—There is a double compartment coarse bar screen chamber 30 in. long, 36 in. wide and 36 in. deep with 2x⅜ in. wrought iron bars spaced 2⅜ in. O. C. at a 30° angle. This is connected by 204 ft. of 10 in. vitrified clay pipe with the pre-settling tank, which has a double hopper bottom. This tank is 16 ft. long and 8 ft. wide, with a vertical depth of 5 ft. and a total depth of 9 ft. to the bottom of the hoppers. The drains from the hoppers discharge directly into the waste line. There are two outlets for the sewage; one at the same level as the effluent line, the other 5 in. lower. This tank with a capacity of 6,064 gals. can also be used as a storage basin during temporary shutdowns of the plant.

The liquid from the presettling tank flows through 52 ft. 8 in. of 10 in. vitrified clay pipe to a concrete diversion box 30x30x18 in. where it is mixed with the returned activated sludge. An arrangement of shear gates in the diversion box allows the sewage to be by-passed around the plant to the waste line.

Novel Feature of Aeration Tanks.—The two aeration tanks are each 42 ft. long, 8 ft. wide and have an effective depth of 11 ft. The capacity of each tank is 23,517 gal. They are arranged so that they may be used independently of each other or in series. The ridge and furrow system of aeration is used, the bottom of the tanks having a row of 37 Filtros plates on each side of a center cross ridge. The novel feature of the design is the arrangement for the compressed air. An air channel 11 in. wide and 7 in deep runs the entire length of the tanks under each row of filtros plates, which are 12 in. square by 1½ in. thick. The holders for the plates were made by increasing the width of the upper 1½ in. of the air channel to 13 ins. and placing 2½x1¼ in. x 2.87 lbs. T-irons across the channel, the ends resting on the concrete ledge. When the filtros plates were in place the ½ in. space on each edge was filled with a cement grout. The air is water-washed and no air filters are used. An aeration period of 5½ to 6 hours is producing a satisfactory sludge.

The Slow Settling Tank.—The activated sludge and aerated liquor flow through a trough, which has submerged parts, into the slow settling tank. This tank is 16 ft. square by 13 ft. deep with a capacity of 22,547 gal. the bottom sloping slightly towards the center. It is equipped with a Dorr clarifier, which makes one revolution every 4½ minutes, the scraping blades on the arms moving the thickened sludge to the hopper bottom at the center. A cast iron pipe connects the hopper bottom with the pump which returns

the activated sludge to the diversion box. When sludge accumulates, in excess of that necessary to maintain the 20 per cent sludge content of the tanks, it is drawn off by gravity into the waste line.

A pump with a capacity of 90 gal. per minute was originally used to pump the sludge. This pump failed in July, 1927, probably due to the impossibility of keeping ordinary grease in the bottom bushings. This caused the shaft and the augurs for lifting the sludge to wear rapidly. This pump has been replaced with an air lift pump, which utilizes the excess amount of air produced by the compressors.

Coagulating Chamber.—The clarified liquor from the slow settling tank flows over a 12 in. submerged weir into a trough with a Stein weir and then into a coagulating chamber 16 ft. long 5 ft. wide and 13 ft. deep. It was originally intended to treat the liquor with alum at this point and an alum solution tank and an automatic feeding device were installed. It was found, however, that alum made the reclaimed sewage too acid for the boilers. Since they have stopped using alum, laboratory tests have shown that the alkalinity of the sewage was reduced from 200 p. p. m. to approximately 25 p. p. m. in passing through the plant. A satisfactory organic mat is now formed on the filters without the use of coagulants and the filters will operate properly if there is less than 15 p. p. m. suspended matter in the effluent from the slow settling tank.

Sand Filters.—The two sand filters are 10 ft. long, 16 ft. wide and 6 ft. deep. There is 52 in. of filtering medium arranged as follows: 8 in. passing through 2½ in. mesh and retained on a 1½ in. mesh. 4 in. passing through a 1½ in. mesh and retained on a ¾ in. mesh. 4 in. passing through a ¾ in. mesh and retained on a ¼ in. mesh. 4 in. passing through a ¼ in. mesh and retained on a 1/12 in. mesh. On top of this gravel is a 32 in. layer of sand with an effective size of 0.40 to 0.45 in. and a uniformity coefficient of approximately 1.6. Large cast iron underdrains were specially designed to collect the filtered water and carry it through the Venturi meters, connected with the rate of flow gages to the clear well.

Water for washing the filters is stored in a 12,000 gal. corrugated metal tank located on the hill above the plant giving a 30 ft. head. The wash water flows through an 8 in. cast iron pipe and is forced through the cast iron underdrains and the filtering material. The dirty wash water is carried off through a trough to a 15,000 gal. settling basin. From this basin it is pumped into the presettling tank so that it may again be purified and no water wasted. Six to eight thousand gallons of water are used for cleaning the filters, the average time between washings is 52.6 hours.

Chlorination of Effluent.—The clear well is 9 ft. long, 16 ft. wide and 5 ft. 6 in. deep. The treated effluent is sterilized in the clear well with liquid chlorine applied near the pump suction with a Wallace and Tiernan S. A. V. A. semi-automatically controlled vacuum feed machine. The average dosage is 3.6 p. p. m. Ortho-tolidine tests are made to regulate the excess chlorine which is kept at 0.5 p. p. m. The suspended matter, which varies from 138 to 389 p. p. m. in the raw sewage, is reduced to about 3.0 p. p. m. in the clear well, the ammonia nitrogen, is reduced 97 to 99 per cent, the dissolved oxygen averages from 3.1 to 6.0 p. p. m. while the B. O. D. varies from 0.5 to 2.5 p. p. m.

Pipe System for Effluent.—Three-stage centrifugal pumps, size 2, made by the American Well Works Company, operating under a maximum head of 125 ft. deliver the reclaimed sewage to a 250,000 gal. covered metal storage tank located at a high point in the village. Standard class B cast iron pipes are used for the gravity mains and branches. These pipes are encased in vitrified tile and where exposed are painted red. An accurate print has been made of the entire system of piping for the reclaimed sewage, so the lines may be easily identified in the future, and to eliminate any possibility of their being cross connected with the clear water lines.

Uses of Effluent.—It has been found that the reclaimed sewage is softer than the clear water and more satisfactory for boiler use. In order to further conserve water, the laundry waste is now being added to the raw sewage and satisfactorily treated at the plant. The plant now furnishes approximately 1,281,750 gals. of reclaimed sewage a month to the Santa Fe Railway. This is used to cool the Diesel engines, for the cooling tower of the ice plant, locomotive boilers, irrigating the lawns, and fire protection. At present there is an excess above the demand, so the railroad is planning to use this water for flushing the toilets at the passenger station and Bright Angel Camp and possibly for washing automobiles. The government uses it for flushing the toilets at the public camp ground and for the sprinkling of the recreation field.

The plant is in charge of D. Travaini, a graduate sanitary engineer, and it is largely due to his great interest and technical skill that the plant has operated so successfully. Construction and operating data for this paper were furnished by M. R. Tillotson, Superintendent of Grand Canyon National Park, D. Travaini, and E. Nelson, Chief Engineer for the Santa Fe Ry. at Grand Canyon.

Acknowledgment.—The foregoing is a paper prepared for the 10th Texas Water Works Short School.

Family Allowance Fund in Belgium

Under the terms of a recently enacted law in Belgium, according to the New York Times, all contracts relative to works executed or subsidized by the State, provinces or communes must include a clause making it obligatory upon contractors to become members of a compensation fund for family allowances.

Industrial establishments from whom the State, provinces and communes order supplies are also obliged to be members of a compensation fund, provided supplies are furnished to the amount of at least 50,000 francs. The same is likewise imposed upon subcontractors. Public service enterprises conducted under concessions come under the provisions of this act, and the King may extend its provisions to public establishments and to institutions of public utility.

In order to meet the requirements of the law, compensation funds for family allowances should assure, for each child under 14 years of age, payment of a monthly allowance of at least 15 francs for the first child, 20 francs for the second child, 40 francs for the third child and 80 francs for each subsequent child. The King has authority, however, to allow compensation funds to adopt another scale, provided the resulting cost is not below that involved in the fixed scale given above.

In no case is a compensation fund obliged to distribute in a family allowances more than 3 per cent in excess of the total wages and salaries paid by all the establishments affiliated with such fund.

Family allowances must be paid to both wage earners and salaried employes, and will be proportioned to the number of days actually worked by the wage earner or employe in the month. In all cases such allowances accrue from the first day worked. Consideration will be given to interruptions due to sickness, accident, unemployment, and for all other legitimate causes.

Allowances will be paid to employes and workers, without distinction of sex, for their own children, stepchildren and children whom they are actually taking care of because of abandonment or because of the death or illness of such children's fathers or mothers. Account is also to be taken of recognized illegitimate children. Under certain circumstances allowances are paid for children up to 18 years of age. The act is to go into effect in October.

Some Unusual Conditions Discovered Through Pitometer Water Waste Surveys

Paper Read Before Central States Section
of American Water Works Association

By H. E. BECKWITH
District Manager, The Pitometer Co.

IT IS NOT the purpose of this paper to deal with the technical aspect of the work being done by our company, but it is merely the recital, in an informal manner, of several conditions encountered in our work which are of interest principally because they are unusual.

In calling attention to those conditions which we have encountered in our work, I am desiring to return in small measure the helpful courtesies shown us by the men in the water works field, and with the hope that you may find some helpful hint in the conditions we have found to exist on other plants.

Closed Valves.—It is, of course, very common for us to find closed valves. Your attention is called to two such instances: In the first of these an entire town of some twenty thousand persons was being fed through four six-inch mains, because a valve on the main sixteen inch feed was closed. Moreover, this was the only valve in the entire system found closed, showing that care was taken to check up on the valves. Furthermore, and this is of special importance, it was the only geared valve in the system. When the operating nut on the gear was turned in a clockwise direction, the valve stem was turned counter-clockwise. As the valve stem on this valve closed in the same direction as all other valve stems in the system, it was necessary to turn the operating nut in the direction opposite to that of every other operating nut in order to close the valve. Someone failed to take this into consideration, with the result that the valve had been kept habitually closed.

Hydraulic Grade Line.—In the second case, the hydraulic grade line was apparently lower at one point than it was at another point on the same line, three-quarters of a mile further from the source of supply. This was on the system of a small company serving several miles of territory with laterals feeding directly off one long main—or rather—it had been one long main originally. For a mile and a half of its length it had later been paralleled with another main. This second main was tied to the orginal main at no place other than at its ends, and no laterals came off of it. A study was being made for the purpose of reinforcing the system. When the hydraulic gradient for the system, as determined in the field, was plotted on cross-section paper, it was found that mid-way between the ends of the two parallel mains the hydraulic grade line was lower than at either end. Subsequently, the valve on the reservoir end of the "old" main was found to be closed. All water being used along the mile and a half of parallel mains had to go to the father end and then feed back toward the reservoir. Opening the closed valve, of course, took the sag out of the grade line and increased pressure below the point where the valve had been closed. The trouble in this case was caused by right and left-hand valves being indiscriminately sprinkled throughout the system.

Reservoir Cases.—Speaking of hydraulic gradients: There is the case of the city whose officials had believed their system was being fed by two mains from the reservoir. A Pitometer test proved, however, that there was no flow through one of these pipes. Further investigation showed that this main at one point actually lay above the water-level of the reservoir.

Another very interesting case was that of a city which had originally been served by two separate companies. Later, these companies were merged and the distribution system inter-connected. Each of these companies originally secured its water by gravity from a mountain reservoir, the reservoir of one company being twelve feet higher than that of the other company. Since the complete metering of this system a few years ago the meters through which water was sold had accounted for a little less than fifty per cent of the water shown on the Venturi meters installed at the reservoirs. Our tests showed that during the night, when the use of water in the system dropped low, the water fed out of the higher reservoir into the lower. The water which fed from the higher to the lower reservoir was measured on each of the two Venturi meters, although as a matter of fact, it was never used in the distribution system at all.

Whenever a water system is fed by gravity from two or more reservoirs on different levels, it is well to grow immediately suspicious of back-feeding when the supply in the lower reservoir holds up better than the supply in the upper ones.

Incorrect Meter Reading.—Another very interesting case was that of a small suburban city which purchased water from its larger neighbor by meter. As the city was being paid on its meters for less than half the water entering the distribution system, the water department had accumulated a large deficit. In addition to the conditions usually found by a survey, it was discovered that two four-inch meters and two six-inch meters were being incorrectly read, and that the city was being paid for only ten per cent of the water going through them. The value of the water which had passed through the meters, but which had never been paid for, was nearly equal to the deficit of the department. An effort was made to collect this money on the grounds that the bills rendered the consumer bore the meter-readings and his acceptance and payment of the bills constituted an acceptance of the correctness of the meter-readings. As the department did not use a step rate, the matter of billing was comparatively simple.

This under-reading was caused by the fact that the smallest dial on the meters involved was graduated in units of one hundred, whereas the smallest dial on all other meters on the system was graduated in units of ten.

That this is not the only case of its kind is shown by the fact that another similar condition was recently found. As a remedy for this it is suggested that meter-readers be not permitted to take their previous readings on a meter into the field and so help to carry the error through, and it is further suggested that the office clerks be forbidden to change any readings in order to make them conform to previous readings. Wherever a doubt exists as to the accuracy of the reading on a large meter it would be well to have it checked by the meter company's representative.

Meter Out of Water.—Another suburban city, which also purchased its water through a meter, presented this problem: Periodically, the receipts from the water department would drop below the cost of its water. The trouble in this case lay in a compound meter to a steel mill. The high duty side of this meter was dead; and whenever business was sufficiently good with the steel company to cause a draught of water large enough to throw the flow onto the high duty side of the meter, business was very bad with the water department.

Unrecorded Services.—In another suburban borough which purchased water by meter, the newspapers stated that the leak discovered by the survey had been running for twenty-five years and had cost the borough in that time a quarter of a million dollars. This is not of particular interest here, except as it lends point to another statement made by the same news article. It seems that, when a large sewer was laid past this leak, it was impossible to handle the water with a pump. It was decided that a spring had been tapped and special foundations were put in to protect the sewer. It should be noted here that the leak was from the open end of an abandoned service of which the borough had no record.

Unauthorized Use.—Several years ago, when the stock of privately owned water companies was more or less a drug on the market, and few companies had paid dividends in many, many years, we caused considerable consternation on the part of the president of one company where we were working. It developed that a certain manufacturing company in the city was getting about one hundred thousand gallons of water a day free, through a defective meter. The president of the water company was also president of this factory. It was bad enough, he felt, not to get any dividends on his water company stock, without having the dividends of his factory cut into by increased water bills.

As a matter of fact, we find it generally true that, where water is being taken in an unauthorized manner, it is done without the knowledge or consent of the higher officials of the companies. It is usually some department head who wants to take a short cut to a good showing for his department.

Efficiency of Pumps.—In recent years there has been a rapid increase in the development of electric power, with the result that many water plants have found it economical to substitute electrically driven centrifugal pumps for the old steam plant. Unfortunately, a full realization of the limitations of this type of pumping unit does not seem to have accompanied its installation. In only too many cases the only requirement placed on the pump is that it pump water. No apparent consideration is given to the efficiency with which this work is done. The displacement type of pump allowed so much latitude in operating conditions that many plant operations have not yet come to a full realization that centrifugal pumps operate efficiently only under the design head, and at the design rate of discharge.

No branch of work being done by our firm is more interesting than the efficiency tests on electrically driven centrifugal pumps. In one instance the pumping units were 2 two and a half million gallon pumps, working in parallel to give a combined output of five million gallons per day. These pumps were designed to work against a head of one hundred pounds. The time came when these pumps would not carry the maximum day load. So the output was increased by putting the discharge of these two pumps through a five million gallon pump designed to pump against a head of fifty pounds. This gave, then, an installation designed to pump five million gallons against a head of one hundred and fifty pounds, whereas it was working against a head of only one hundred pounds. This gave an increased rate of discharge but at a considerable cost in efficiency. This was not the sole reason why the wire to water efficiency of the installation was under forty-four per cent, as several pieces of wood were later taken from the ports of one of the pumps, but it did have a very important bearing on the loss of efficiency. It is of interest to add that, after disconnecting the fifty-pound pump from the discharge of the two and a half million gallon pumps, and cleaning these latter out thoroughly, a subsequent test on these two pumps gave an over-all wire to water efficiency in excess of seventy per cent.

Slippage in Pump.—In another instance the clear well was of such small size that it was necessary to coordinate the flow from the filters into the clear well with the pumpage out of it. As the low lift pump from the river to the filters had a higher rate of discharge than had the pump from the clear well to the distribution system, this coordination between the two pumps was secured by partially closing a valve on the discharge of the low lift pump. This increased the head at the pump above its design head and induced a slip into it. So much was this increase in head and slip, that the power required to pump the reduced flow was much more than would have been required to pump the greater quantity for which it had been designed, had it been operating under design conditions. Throttled down, the pump had an over-all efficiency of approximately thirty per cent. A new low lift installation designed for a discharge equal to that of the high lift pump, thereby eliminating the necessity for throttling, gave, on test, an over-all efficiency of approximately sixty per cent.

Queer Design.—Then, there was the centrifugal pump whose ten-inch discharge line was reduced to six inches for a few lengths of pipe. The explanation given for this novel procedure was that the water pressure would be increased after going through the smaller pipe. This reasoning sounds strange to us today, but one of our engineers, delving through the council records of a city where he was working, found a case equally interesting.

Some sixty years ago when our knowledge of hydraulics was not as extensive as it is today, an engineer had been employed to design a main between the reservoir and the city. This main was partly twenty-inch and partly eighteen-inch, fed by a twelve-inch from the reservoir. The engineer in charge of the work made the following statement:

"This main line of pipe was enlarged by the direction of the Committee on Water under the light head at the Westerly end, to render the same much more effective as a means of conveying and delivering water at the extreme end of the pipe here in the city. Since the lighter the head, the larger is the required diameter of the pipes necessary to furnish the amount of water conveyed by the small pipe under a much greater increase of head; this change has been one of much utility in increasing the efficiency of this supply main."

Did Not Work.—Within ten years after the main was put in service, the supply in the city became so deficient that the main was not full at all times. The report of the Water Committee says, "While the discussion was going on about the High Service, the Engineer discovered that the main pipe already laid was wrong end first, and that the advantages of having a small pipe near the reservoir to fill and supply a larger one in the city, were not so great as he at first supposed."

These are only a small part of the interesting conditions found by our company in the thirty years it has been doing its special work. Almost every plant has its own particular problem, and it is not always possible to tell in advance just what that problem is.

Zoning System for Water Bills, Adopted at Toledo, O.

The Commissioner of Water of Toledo, O., has adopted the zoning system for reading meters and paying water bills. The whole city has been divided into six zones of approximately equal size. Meters in each zone will be read twice a year, but the readings and bills due are rotated so that the city will receive payments from one zone each month. This system is in successful operation in several other cities, and it divides the work of the meter readers and the finance department equally throughout the year, making it unnecessary to hire extra readers and clerks for a short period when bills are due.

Pennsylvania County Votes Large Bond Issue.—Allegheny County, Pennsylvania, in which Pittsburgh is located, has voted a $43,680,000 issue for improvements. The specific amounts voted are as follows:

Roads	$ 6,550,000
Boulevards	10,930,000
County parks	1,500,000
Bridges	14,650,000
County office building	2,550,000
County auditorium	6,000,000
Airport	1,500,000

The total of $43,680,000 will be financed over a term of five years at an annual average cost to the taxpayer of 7/10 of a mill, or 70 ct. per $1,000 valuation.

Penetration Macadam

Construction Methods Discussed in Paper Presented at 1927 Highway Conference at University of Colorado

By L. I. HEWES

Deputy Chief Engineer and Director Regional Office U. S. Bureau of Public Roads, San Francisco, Calif.

Modern penetration macadam surface is a wearing surface not greater than 3 in., and usually 2½ in., compacted thickness, composed of clean, uniform sized broken stone combined with bituminous material introduced by the penetration process. Such surfaces are of course placed on adequate bottom courses and where necessary, particularly in New England, on deep sub-base and foundation courses. The present day construction of such top or wearing surfaces by the penetration method is vastly superior in all respects to former practice.

Modern Penetration Macadam Surfaces.—The modern penetration macadam road in the Northeast is built with a heavy stone or gravel foundation and an adequate base course of from 3 to 6 in. in compacted thickness, and the surface itself is composed of the very best stone obtainable at reasonable price, and the most minute care is exercised in all the successive steps of construction. In this connection it is well to note that the early portland cement concrete roads were not particularly good. They were not built with sufficient care, or under adequate inspection. In comparison to the modern type of portland cement concrete pavement construction, the original work now appears crude and sometimes even ridiculous. A parallel situation has existed with respect to bituminous macadam construction. The engineers in Massachusetts and Rhode Island and elsewhere now no longer attempt to build "cheap" penetration surfaces. They are building such roads at a cost of $20,000 to $35,000 per mile, and with excellent service to traffic and low maintenance costs. It is the object of this discussion to consider especially the place which bituminous macadam construction may have in the road development program of the western states, and to point out particularly the advantage which such type of construction has in regions of low rainfall or semi-arid regions where the expensive type of sub-base and foundation courses required by the wetter regions and regions of heavy frost are not necessary. The Bureau of Public Roads has recently awarded contracts in Arizona and California for approximately 50 miles of this type of construction.

Foundation and Base Courses—It is absolutely necessary that a penetration type of wearing course shall be placed on an adequate base course and foundation. It is customary to build the base course of good broken stone, and to fill it with screenings or other fines and develop its solidity by the methods of ordinary or waterbound macadam construction. Such base courses vary in thickness from 3 to 6 in., depending somewhat on the thickness of the wearing or bituminous top course itself, and upon the requirements of the location for sub-base or foundation. In the heavy frost sections or more unfavorable soils in the Northeast, there is always a heavy bottom or foundation course, frequently of broken field stone or of gravel, and 12 to 18 in. thick. In many sections of the arid or semi-arid West such foundation courses will not be required. This does not mean that there will not occur swampy or unfavorable spots on almost any project where heavy foundation will be needed, but there are many hundreds of miles of roads in the plain or rolling areas where drainage and soil conditions are favorable for an excellent natural foundation. It is particularly in such areas that penetration macadam should find favorable consideration.

Top of Penetration Course.—It is to the details of construction of the top wearing course or penetration course proper that attention is particularly directed. The result desired in this surface construction is a "lean" mosaic of relatively large stone without a "fat" or slippery condition. The old specifications in the East did not provide sufficiently large or uniformly sized stone. The best specifications now provide usually for stone 2½ in. maximum size, and 1¼ or 1½ in. minimum size. These sizes are standard for the hard stones known as traps. The desirable product is the one which tends to break in cubical form and without flat or splintered pieces, and one of the merits of trap rock is its tendency to so break when crushed. If trap rock cannot be secured, the hardest and toughest local stone is desirable. Preferably the stone for the wearing course should have a low coefficient of wear, or what is the same thing, a high French coefficient. Wear or loss by the Duval test is sometimes stipulated to not exceed 2 to 4 per cent. This is a rigorous requirement and cannot be fulfilled in many localities. But fortunately successful penetration work can be secured with softer stones. In all cases the stone must be absolutely clean and uniformly spread on the base course, and the base course is left sufficiently rough so that there will be an engagement or locking of the surface course stone with the base. It is readily seen that with 2½ in. maximum size stone spread to produce a compacted course 2½ in. thick, that the tendency is for the course to be a "one stone thick" course. As a result, the tendency for the surface to "shove" or "bunch" or to form waves is practically eliminated. The surface course stone is spread with greatest possible care by skilled workmen, and is rolled until it is thoroughly locked or until a mechanical bond is produced, and must present a uniform surface throughout. It must also present a surface with voids sufficient to take the poured asphalt. In the light of recent experiences, the attempts to pour asphalt into fine crushed stone now seem pitiful. Frequently the stone was so fine, that penetration could not be obtained. When the surface course has been thoroughly locked no travel or disturbance whatever is permitted until the first pouring of the asphalt.

If a relatively soft stone is used, which may show a tendency to crush under the roller, a larger size stone is preferable and stone passing a 3-in. ring and retained on a 1½ in. ring is usually specified. The exact adjustment of the size to the relative hardness is of course a matter of judgment. It should be understood, however, that the fear of producing a rough surface by the use of too large a stone in the surface course no longer exists. It is found that by the use of properly sized "key" or intermediate size stone, spread after the first application of asphalt, the roughness is removed and a rugged, durable, non-skid surface is produced. It should be noticed that a stone passing a 3-in. ring will not generally be 3 in. in all dimensions, and that the stipulation for a compacted 2½ in. surface course, using such large stone, is consistent. The details of inspection required by modern penetration work are exacting. The engineer must see that the rolled top course before applying asphalt is entirely free from dirt of any kind, including leaves or debris which may have blown upon the surface, and that there are no pockets of finest one resulting from a segregation of sizes in the process of hauling or dumping. All such pockets are removed and replaced by uniform size clean stone. The rolled surface must also present a true plane. Recently there have been introduced mechanical spreaders which are dragged behind trucks, which produce a uniform distribution of stone, but it is necessary for truck drivers to gauge carefully the necessary speed. Too much care cannot be given to the preparation of the surface course stone before applying the bituminous material.

First Application of Bituminous Material. — The bituminous material used in the East is relatively hard. The specifications in most instances require a penetration of from 85 to 100. With California asphalts, however, a softer material produces excellent results and it is found unnecessary to use quite as much as is standard in eastern practice. Rhode Island for the first pour applies 1¾ gal. to the square yard. In all cases the application is made by a motor tank distributor, under pressure and at a temperature of approximately 350° F. The pressure should be from 30 to 60 lb. per square inch.

There are many necessary details connected with this first application of bituminous materials to insure success. If any "fat" spots appear they must be dissipated by loosening the stones with an iron rod or pick to allow the material to penetrate, otherwise a lump appears in the finished surface. The nozzles of the distributor must be working freely and for the best results should be blown out with live steam before the distributor is operating. There must be no lapping of distributed asphalt and devices of troughs, tar paper, or sand are used to prevent it. Only truck operators skilled in applying bituminous material can achieve the necessary results. Asphalt must never be applied when there is any moisture in the stone or in wet weather, or at low temperatures, and the best results are obtained during warm weather in the middle of the day.

Key Stone.—Key stone is a clean, fine, hard stone, ranging in size from 1 in., more or less, to about ½ in., and the size is articulated with the range of sizes in the surface course itself. Rhode Island stipulates a size of 1 in. to ⅝-in. key stone when the top course is sized between 2½ and 1½ in. Only sufficient key or intermediate stone is applied to the penetrated course as will just fill the voids and permit rolling. After thorough rolling the excess key stone is swept off clean. It should be understood that the key stone is not an additional layer of stone, but merely a stone introduced in the voids of the surface course and not intended to take the wear. The wear should preferably come on the larger stone and the key stone is to lock the surface and "chink" the voids. No dust or foreign matter whatever is permitted in the key stone, and to avoid hauling over the compacted top course the key stone is stored in advance in piles along the shoulders. The distribution of the key stone on the penetrated top course must be absolutely uniform and never form a mat.

Seal Coat.—When the key stone has been applied, rolled and the surplus removed by sweeping, there is made a final application of asphaltic or bituminous material, formerly known as the seal coat. This application is usually about ½ gal. to the square yard, but may be slightly more or less, and is sometimes applied in two courses of approximately ¼ gal. each. It is not intended to create a smooth, glossy surface, but merely to insure a complete filling of the voids that may still exist after the application of the key stone. The seal coat is immediately covered with stone "chips" which are solid stone particles of from ⅝ to ⅜-in. in size. It is sometimes stipulated in the East that the chips shall be of trap rock even if it has to be brought from a distance.

Rolling.—A major essential to the success of penetration macadam surfaces is adequate rolling. Rolling is preferably concentrated on the surface course stone before the first application of bituminous material and should be continued until there is a solid lock of the particles but never beyond a point where waving of the stone surface recommences, or where there is a visible "rounding" of the edges. In relatively soft stones rolling of the first course may begin to break the stone and crush the surface, and thus develop a condition which would tend to prevent penetration of the asphalt. The moment this condition appears, rolling should stop. However, subsequent to the application of the asphaltic material and the key stone, rolling of the softer stone may safely continue.

In all cases what is known as "back rolling" should continue after the seal coat and chips or screenings have been applied. All the experts agree that rolling for several days after the road is opened to traffic is beneficial, and frequently where a road shows tendency to irregularity a re-rolling in the spring is also beneficial. Often with from one to three rollers on the job it will be observed that the actual rolling time is short. There is a tendency for rollers to be idle and it is well to have a check on the actual rolling time, and see that sufficient rolling is secured.

Conclusion.—This brief discussion is intended to indicate the direction in which lies success in penetration macadam work. It must be understood that the surface course above described must always be on a solid, adequate base course. On well drained roads, or desert roads, it is expected that penetration tops can be applied to old existing gravel or fine crushed rock roads with success. With sufficient sub-base or foundation courses, it is now common in the East to consider that penetration macadam will stand up under almost any traffic, including considerable heavy motor traffic, that is likely to come upon it. It is certain that for moderate traffic modern penetration surfaces are adequate. With the new specifications and the increased care in manufacture, the cost of maintenance has been greatly reduced and is not expected to exceed $150 per mile per year.

Western Penetration Jobs.—There is given below a brief abstract of the specifications and prices for three jobs for which the Bureau of Public Roads has recently opened bids:

Flagstaff-Angel Forest Highway Project in Arizona.—23.44 miles, 18 ft. wide, 2½-in. compacted penetration top on a nineteen-foot wide base of five inches loose fine crushed malpais (dragged and rolled and under traffic for a year or more). The top is also ledge malpais sized 2½ in. to 1¼ in., with key stone and screenings both ¾-in. to ¼-in. The asphaltic material is 90 to 95 per cent road oil furnished by the Bureau. Bids were opened June 30, 1925, and the price is 65c per square yard for top course in place, and the total cost per square yard including the base course is $1.16.

Grand Canyon National Park.—14.85 miles for which bids were opened Dec. 21, 1925. Two-inch compacted penetration top on 4 in. of ordinary macadam base, $1.25 per square yard complete in place. There is a long haul for stone. The base is 1 ft. wider than the top. The asphaltic material will be selected later by the Bureau. The base course stone is sized 2½ to 1¼ in., and filled with screenings ⅝-in. to dust. The top course is limestone 2½ to 1¼ in., and the key stone will be 1¼ to ⅝ in., and binder 1 to 1½ gal. for the first pour, and a seal of ¼ to ½ gal.

Yosemite National Park.—Bids were opened Dec. 28, 1926, for 15.15 miles of 2½-in. penetration macadam, on a 4-in. compacted macadam base, on disintegrated granite subgrade, and the low bid was equivalent to $1.25 per square yard complete in place. The top course stone is altered trap, sized 2½ to 1¼ in., with key stone 1¼ to ⅝-in., and a 90 to 95 per cent road oil will be used alternately with California asphaltic oil of penetration from 110 to 130.

Motor Traffic Roads in Germany

The road building conference, held at the Leipbig, Germany, fair, Aug. 28 to Sept. 5, was attended by numerous officials, engineers, and contractors. From the discussions it appeared that German experts no longer favor the building of long distance motor traffic boulevards, such as those originally planned between Berlin-Leipzig-Munich and Hamburg-Frankfurt-Basel. They consider, on the contrary, that boulevards exclusively for motor traffic need only be built on short stretches of particular importance, such as, for example, Leipzig-Halle or Cologne-Dusseldorf. For such stretches concrete roadways nine meters wide are recommended. Exclusive of such stretches it is believed that the existing net work of rural highways will suffice for motor traffic, provided the road surfacing is greatly improved.

In order to obtain the necessary funds for improving the roads and rendering them fit for heavy motor traffic, two new types of taxation were proposed. The first was an additional tax on automobiles to be levied by weight; the second a tax on automobile tires, of about 30 per cent ad volore, to be levied by the customs officials as the tires enter the country. Taxes on motor fuel were not suggested.

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

Our New Department

With this issue DISTRIBUTOR NEWS, the new department in The Gillette Construction Group of magazines greets the distributor and the manufacturer's representative. Following the Gillette policy of rendering the best possible service to our readers and advertisers, this department has been established to give prominence to the individual and trade news concerning the distributor.

It is our purpose to present in these pages (which will be found in every issue hereafter under the title given above) topics of interest to the distributor as they may relate to the manufacturer and contractor in the various fields which the Gillette publications cover.

We have named the department DISTRIBUTOR NEWS because it is all inclusive. Under this heading we hope to present news of all kinds as it pertains to this field. Space will be given to selling, shipping and service methods as they contribute to the growth of business and the promotion of goodwill competition.

The equipment user may think of the factory as the whole source of supply, whereas, due to the efforts of the distributor working with the manufacturer, machinery and repair parts are distributed throughout the entire country where the operator can obtain them on the shortest notice. Who the distributor is, where he is and how he renders service are a few points to be looked for in DISTRIBUTOR NEWS.

We should like to hear from our friends throughout the country with suggestions for these columns. If you have questions which you would like to have other distributors answer, send them in and we will run a Question Box to take care of them. Illustrations of warehouses, improvements, or pictures which tell a story will all be welcome. Photographs, too, will be used when for some reason someone is entitled to a special introduction to the readers of DISTRIBUTOR NEWS. These pages belong to you, let us hear from you. Communications for this department should be addressed to The Editor, DISTRIBUTOR NEWS, Gillette Publishing Company, 221 E. 20th St., Chicago.

Distributors Discuss Equipment Credits at Conference

Problems Discussed at San Francisco Banquet

THE Executive Committee of the Associated Equipment Distributors, which is the national organization of equipment distributors, held their semi-annual meeting in San Francisco Aug. 6 to 11.

During this meeting the committee went on record endorsing the principles being established by the Associated General Contractors on the elimination of false credits in the sale of construction equipment and pledged the support of their entire organization in conferences which are now taking place, sponsored by the A. G. C. on this matter, and their complete accord with the agreements which will be reached between the manufacturers and the A. G. C.

Composed of men prominent in the field of distribution of construction equipment, from an organization country wide in its scope, and themselves individuals who are executives of large firms, they recognize the mutual responsibility of the manufacturer, the distributor and the contractor, and they voluntarily assume their share of the load.

Edward R. Bacon of San Francisco, personally and as National President of the Associated Equipment Distributors, strongly endorses the work now being done by the Associated General Contractors and predicts the eventual working out of a harmonious plan which will be of great benefit to all concerned.

At the direction of the Executive Committee, Mr. A. C. Blaisdell, who is the Secretary of the Associated Equipment Distributors, will take part in the conferences being sponsored by the A. G. C. as their representative. Mr. Blaisdell has already taken a prominent part in the conferences to date and he is thoroughly sold on the merit of the plan of co-operation between the manufacturer, the distributor and the contractor, and is a strong advocate of the adoption of standard credit terms.

The Banquet.—On the evening of Aug. 8 the members of the Executive Committee of the Associated Equipment Distributors and the Board of Directors of the Northern California Chapter, A. G. C., were the guests of the Associated Machinery Merchants of Northern California at a banquet tendered them in the Palace Hotel. For this banquet the entertainment committee of the Machinery Dealers had provided unique table decorations in the form of miniature models of all kinds of construction equipment and a replica of a paved road.

Mr. L. E. Murphy of the A. L. Young Machinery Company was the toastmaster and after the introduction of the visitors short talks were made by a number of those present.

That the standardization of equipment credits is a matter of general interest throughout the country is indicated by the fact that at this banquet the brief remarks of everyone present concerned the activities of the A. G. C. in this field and the accomplishments to date in various sections of the country. Coming from all parts of the country the members of the Executive Committee of the Associated Equipment Distributors in their individual interest give a true cross-section of the country wide interest which now prevails in this work.

Significant were the remarks of Mr. Blaisdell of Cincinnati and of Mr. Hunter of Milwaukee.

Cincinnati Association.—Mr. Blaisdell stated that in his city, Cincinnati, all equipment dealers and distributors had formed an association and had agreed to abide by the terms of credit recommended by the A. G. C. They are exchanging credit information among

members and are overcoming the trade-in evil. On their part the Cincinnati Chapter of the A. G. C. had agreed that all members of the Chapter would place their orders for equipment through the local dealers instead of in other cities as had been largely the custom in the past and that the contractors would abide by the credit terms and not ask for unreasonable concessions in trade-ins, cash discounts, etc.

Wisconsin Organization.—Mr. Hunter told those assembled that in his state, Wisconsin, the construction industry was completely organized in the form of a Construction Industries Council. This council is composed of 25 branches of the industry, each branch represented by 3 men, a council total of 75 men. Taking part in the affairs of the council are such groups as the bankers, the machinery men, the material dealers, the lumbermen, the contractors, the insurance men, etc. Mr. Hunter further pointed out that in his state the construction industry accepts dictation from no one but on the other hand it dictates the policies which prevail, consequently they were not overridden with restrictive statutes and other hindrances to progressive business. He also declared that the construction industry in any other state if it ever expects to get anywhere must do likewise, that is, it must be a leader and not a follower.

Officers Present.—Officers and members of the Executive Committee of the Associated Equipment Distributors who were present at the meeting in San Francisco were as follows:

Edward R. Bacon, of the Edward R. Bacon Co., San Francisco, president.

Carl Borchert, of the Borchert-Ingersoll Co., St. Paul, Minn., second vice-president.

A. C. Blaisdell, of the Queen City Supply Co., Cincinnati, O., secretary.

Geo. F. Smith, of the Geo. F. Smith Co., St. Louis, Mo., treasurer.

J. W. Bartholow, of the J. W. Bartholow Co., Dallas, Tex.

O. B. Bjorge, of the Clyde Equipment Co., Portland, Ore.

Dan R. Brown, of the Brown-Bevis Co., Los Angeles, Cal.

N. Floyd, Jr., of the Hubbard Floyd Co., New York City.

A. A. Fuchs, of the Fuchs Equipment Co., Omaha, Neb.

M. R. Hunter, of the Hunter Machinery Co., Milwaukee and Detroit.

H. G. Ferris, of the Hofius-Ferris Co., of Spokane, Wash.

Annual Meeting.—The annual meeting of the Associated Equipment Distributors will be held in Cleveland, O., on Jan. 13 and 14, 1929, just prior to the Road Show.

Complimentary Dinner tendered to
EXECUTIVE COMMITTEE OF ASSOCIATED EQUIPMENT DISTRI
and
DIRECTORS OF ASSOCIATED GENERAL CONTRACTORS
Northern California Chapter
by the
ASSOCIATED MACHINERY DEALERS
of Northern California
Palace Hotel - San Francisco - August 8, 1928

Members and Guests Present at Banquet in the Palace Hotel

1. H. L. Hewitt, The Rix Company, San Francisco.
2. A. A. Fuchs, Fuchs Equipment Co., Omaha, Neb.
3. Al Hartley, Edward R. Bacon Co., San Francisco.
4. Carl Kratz, A. L. Young Machinery Co., San Francisco.
5. H. L. Terwilliger, Ingersoll-Rand Co., San Francisco.
6. E. S. Berney, Director, Northern California Chapter, A. G. C.
7. P. H. Curtis, Western Construction News, San Francisco.
8. E. S. Jenison, Jenison Machinery Co., San Francisco.
9. N. Floyd, Jr., Hubbard Floyd Co., New York City.
10. J. F. Knapp, Director, Northern California Chapter, A. G. C.
11. Edward R. Bacon, Edward R. Bacon Co., San Francisco.
12. L. E. Murphy, A. L. Young Machinery Co., San Francisco.
13. C. C. Chamberlin, Austin-Western Machinery Co., San Francisco.
14. F. C. Edmonds, Harron, Rickard & McCone Co., San Francisco.
15. J. W. Bartholow, J. W. Bartholow Co., Dallas, Tex.
16. C. A. Garfield, Garfield & Co., San Francisco.
17. Geo. F. Smith, Geo. F. Smith Co., St. Louis, Mo.
18. John Jorgensen, Contractors Machinery Exchange, Oakland.
19. Stanley Kulp, Ingersoll-Rand Co., San Francisco.
20. H. G. Ferris, Hofius-Ferris Co., Spokane, Wash.
21. W. W. Mutter, Northwest Engineering Co., San Francisco.
22. E. G. Lloyd, Manager, Northern California Chapter, A. G. C.
23. A. E. Mason, Norris K. Davis Co., San Francisco.
24. Carl Borchert, Borchert-Ingersoll Co., St. Paul.
25. Stuart S. Smith, Jenison Machinery Co., San Francisco.
26. R. W. Arns, Gardner-Denver Co., San Francisco.
27. Fred Stebinger, Edward R. Bacon Co., San Francisco.
28. D. M. Burgess, Schramm, Inc., San Francisco.
29. O. B. Bjorge, Clyde Equipment Co., Portland, Ore.
30. Bert Engstrom, Marion Steam Shovel Co., San Francisco.
31. Adolph Teichert, Jr., Director, Northern California Chapter, A. G. C.
32. J. S. Berkefield, O. R. Peterson Co., San Francisco.
33. M. R. Hunter, Hunter Machinery Co., Milwaukee, Wis.
34. Tracy W. Harron, Harron, Richard & McCone Co., San Francisco.
35. Jas. S. Caldwell, President, Northern California Chapter, A. G. C.
36. W. A. Mayther, Gardner-Denver Company, San Francisco.
37. Floyd O. Booe, Assoc. Mgr., Northern California Chapter, A. G. C.
38. A. C. Blaisdell, Queen City Supply Co., Cincinnati, O.
39. S. H. Wade, Western Construction News, San Francisco.
40. H. A. Olds, Edward R. Bacon Co., San Francisco.
41. Ed. Lietch, Lietch & Co., San Francisco.
42. Fred Weddleton, Western Road Show, San Francisco.
43. A. C. Becker, Schramm, Inc., San Francisco.
44. S. J. Clark, Edward B. Bacon Co., San Francisco.

Enroute

Mr. Earle S. Phillips, vice-president and manager of the Good Roads Machinery Company, Inc., Kennett Square, Pa., is on an extended trip to the Pacific Northwest. From that section the itinerary will include the entire Pacific Coast territory with a return by way of the southern route.

Mr. Phillips is making this trip to intimately study conditions in the various sales territories as relating to the products of the company, and visiting the direct representatives and dealers who represent the company from coast to coast.

The products of the Good Roads Machinery Company include rock crushers, elevating, conveying, screening and washing equipment. Complete sand and gravel producing plants, motor graders, hot oil distributors and a very complete line of snow plows for attaching to motor trucks.

An Old Firm with a New Name

Announcement has been received of the organization of The Bingham & Taylor Corporation. This company has taken over the foundry business established by Mr. Robert Bingham in 1849, and operated continuously since 1903 under the name of the W. P. Taylor Company. This foundry is one of the oldest of its kind in the United States, with a record of eighty years of continuous service.

Mr. James W. Gibney, for 26 years the Works Manager of the foundry, is the President and General Manager of the new corporation. Mr. Gibney states that the plant is equipped with three large cupola furnaces with a daily capacity of approximately 150 tons; two electric furnaces for the manufacture of high grade steel castings and crucible and reverberatory furnaces for the manufacture of brass and other alloys.

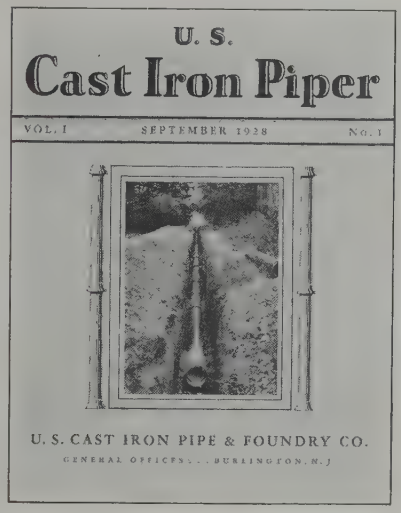
Soon after the founding of the plant by Mr. Robert Bingham, his son, Mr. Charles Bingham, was taken into partnership and the firm was operated under the name of Bingham & Son. In 1884 W. Perry Taylor secured an interest and has been identified with the company until the present time. With Mr. Taylor's entrance into the firm, the name became Bingham & Taylor, and was nationally known in the manufacture of gas and water works supplies. The company also manufactures railroad castings and general foundry products, many of which are known all over the world.

Mr. Taylor, now in his eightieth year, is retiring from business. He was formerly general superintendent of the Michigan Central Railroad, and is one of Buffalo's best known citizens.

The other officers of the new company are: Mr. William J. Gibney, vice-president, and Joe H. Gardner, secretary and treasurer. The office is located at the plant at 575 Howard Street, Buffalo.

A Piper on Pipe

Distributor News is very happy to introduce to its readers U. S. Cast Iron Piper, a brand new house organ published by the U. S. Cast Iron Pipe & Foundry Company. The illustration is a fac-simile of the attractive cover of



the first number of this paper. The editor's announcement reads:

"The United States Cast Iron Pipe & Foundry Company presents the 'U. S. Cast Iron Piper.' This magazine will be published quarterly and will contain articles and illustrations pertinent to the manufacturer and use of cast iron pipe and fittings, as well as sugar house equipment, fertilizer machinery, gas producers and other products manufactured by the company. The 'U. S. Cast Iron Piper' will be mailed regularly to those from whom requests are received."

This little magazine is handsomely gotten up, on heavy enamel paper, and is well illustrated. As to the contents, we will leave that for you to find out when you send for your copy.

Rebuilt Tractors Aid in Flood Control

The photograph shows two rebuilt Holt "Caterpillar" 5-ton tractors leaving the yards of McDonald & Burgman, "Caterpillar" dealers in Florida, for

Rebuilt "Caterpillar" 5-Ton Tractors Leaving McDonald & Burgman Shops for Mississippi Levee Work. Sold to Thompson & Moseley

shipment to Louisiana, where Thompson & Moseley, Tampa contractors, are working on levee construction for flood control.

These old model tractors are taken in on trade and are torn down to the last nut and bolt. All parts are thoroughly cleansed in a large boiler filled with Oakite solution and the work of reassembling begun. Every part that shows signs of wear, or possible future failure are replaced with new parts. Cylinders are rebored, new bearings fitted and the entire motor made like new. The entire tractor is made new. The useful life is prolonged many years.

Mr. H. L. McDonald reports that the demand for "Caterpillar" tractors among Florida road builders and construction companies is growing, and rebuilt tractors as they are turned out at the Jacksonville shops are in great demand. Thompson & Moseley have five "Caterpillars" on their present contract.

Good News

To the people basking in the sun of California it is always a pleasant sensation, but local in its benefits. But, when the rays extend so that others far removed from the geographical limits of the state feel them they become a national asset.

Such is the reaction to the optomistic report on business conditions in Southern California recently received from Mr. H. G. Bley, president of the Construction Machinery Company, of Los Angeles. Mr. Bley reports that August of this year was the third largest month in the history of their business and was preceded by four or five months showing a marked increase. The volume of business in concrete mixers and hoists has shown a decided increase and the prospects are excellent for a big demand for revolving gas-shovels and portable compressors.

Mr. Bley's outlook for Southern California during the next three or four years is most optomistic and he predicts the greatest growth of any like period in its history. The Construction Machinery Company handle contractor's equipment and woodworking machinery. They are located at 455 East Third St., Los Angeles, Cal.

More Good News

The G. C. Phillips Tractor Company, Birmingham, Ala., report that their business for the first eight months of 1928 exceeds all previous years by a large margin. They are adding a number of well known lines and starting Jan. 1, 1929, they expect to handle a complete line of contractors' equipment. They state that they are in the market for additional lines and would be pleased to hear from the manufacturers of contractors equipment and road building machinery.

W. A. Riddell Company Holds Sales Conference

The W. A. Riddell Company recently held a three-day Sales Conference at Bucyrus, O., where their general offices and factories are located.

The entire sales force, with one exception, was present. Arrivals, making acquaintances and renewing friendships occupied the first morning. After lunch the men made a tour of the factory, and later films showing Warco road machinery in operation were exhibited.

At 6:30 the salesmen were invited to the Elks' Club, where they were guests of the company at a banquet. Mr. Geo. M. Schmidt, general manager, read a communication from Mr. Riddell, the president, wherein he expressed regret at his inability to be in attendance, but declared himself as being back of every salesman 100 per cent. Mr. Schmidt then introduced as toastmaster the new sales manager, Mr. N. E. Jersey. Mr. Jersey has served the company as designing and experimental engineer, chief engineer of track and grader department, and as sales engineer. His appointment, Aug. 1, as sales manager filled the vacancy occasioned by the resignation of Mr. R. O. Perrott. Mr. Jersey introduced representatives of the collection, accounting, credit, sales, advertising, roller, scoop, track and grader departments, all of whom gave the salesmen an insight into their particular problems.

Factory inspection and witnessing of manufacturing operations, occupied the second morning. The afternoon was given over to testing and demonstrating Warco road machinery on the proving ground near the company's south shop. In the evening the salesmen banqueted the officials and department representatives, and sponsored by Mr. Jersey, presented their side of the story.

The last day was spent in conferences with the credit and collection departments, and with individual sales conferences. After dinner an informal conference of the round table type was the order of the evening; it resulted in a closer understanding of each others problems by salesmen and home office representatives, alike. The conference was most successful, and the salesmen are enthusiastic over the plans of the company, and the future outlook of Warco road machinery.

$1,000,000 Chemical Plant for Tacoma

Construction work is now well under way for the new $1,000,000 plant for the Hooker Electro-Chemical Company on the 21-acre tract of land on the Tacoma tideflats. This is to be a main branch of the company located at Niagara Falls, N. Y. Construction will be speeded up so that the plant can be placed in operation by Jan. 1, 1929. About 150 men will be employed in this plant. The site has a frontage of 1,000 ft. on Hylebos Waterway and is easily accessible to deep sea vessels.

At the start the Tacoma plant will probably confine its operations to caustic soda and liquid chlorine, but its plans and facilities are designed for expansion as the growing requirements of the Northwest may provide markets for other chemicals.

The officers of this company are: Elon H. Hooker, president; Willard Hooker, vice-president and treasurer; H. M. Hooker, vice-president and sales manager; A. H. Hooker, technical director, and L. A. Ward, secretary. Albert H. Hooker, Jr., has been representing the sales and service work for the company on the Pacific Coast for sometime past.

Notes of the Trade

The following notes about men in the equipment and material fields, of interest to the distributor, the manufacturer, their men on the firing line, and those who buy their products, have been recently received.

Mr. C. Phillip Dearman has recently been appointed exclusive representative for M. V. Hendricks Company of Morenci, Mich., and the Chausse Oil Burner Company, Elkhart, Ind. Mr. Dearman's territory will include Illinois, Wisconsin and the northwestern portion of Indiana. Mr. Dearman is well equipped to handle these lines, as he is an experienced man in the oil and bituminous industries. Before assuming his present position Mr. Dearman was connected with the New Orleans Refining Company, and previous to that time served in the London offices of the Shell interests. Distributor News is glad of this opportunity to present Mr. Dearman to his fellow distributors. His Chicago office is located at 105 N. Clark St.

Chicago Pneumatic Tool Company announced the appointment of Mr. H. H. Sherman as manager of the Publicity Department, with headquarters at the general offices of the company, Chicago Pneumatic Building, 6 East 44th St., New York. The company is a large manufacturer of pneumatic and electric tools, air compressors, rock drills, engines, etc., having four plants in the United States, one in Canada, one in England and one in Germany, and other branches throughout the world. Mr. Sherman joined the company in 1927 as assistant publicity manager and has had years of experience in industrial advertising and advertising agency work. Mr. Sherman believes in trade paper and direct mail to secure results.

The T. L. Smith Company, manufacturers of mixers and pavers, announce the appointment of J. B. Harbison Equipment Company of Little Rock, Ark., as Smith distributors for their state. Mr. J. B. Harbison is well known to the trade, having been formerly associated with the O. B. Avery Company.

Paradon Manufacturing Company, Arlington, N. J., announce the appointment of Mr. Gerald Standish as assistant manager of sales. Mr. Standish will have general supervision of the sales of Paradon Chlorinators east of the Mississippi River.

Mr. J. W. Cliff has recently joined the MacGregor Valve Company in St. Louis as production manager. Mr. Cliff has had wide experience, holding important executive and engineering positions with such firms as the Power Accounting Company, Hyatt Roller Bearing Company, Wright-Martin Aircraft Company, Lehigh Accounting Company, Weston Instrument Company and for the last five years was shop superintendent manufacturing Merco-Nordstrom Valves. Under his jurisdiction the MacGregor Valve Company is having machines installed for quantity production of MacGregor Rotary Valves —the latest development in the lubricated valve field.

Mr. A. F. Barron, 30 N. Michigan Ave., Chicago, has been appointed sales representative for the Paradon Manufacturing Company, Arlington, N. J. Mr. Barron will have charge of sales and service of Paradon chlorinators in the states of Illinois, Indiana and southern Wisconsin.

Mr. W. J. Dunn, Sr., of the Dunn Machinery Company of Atlanta, Ga., signs his letters "Yours very truly, year after year." This company has been in business for 38 years and carries machinery for factory, mill and farm, as well as waterworks equipment. Mr. Dunn is a seasoned machinery man.

The J. B. Harbison Equipment Company, of Little Rock, Ark., has purchased the branch holdings of O. B. Avery Company now located at 209 Spring St. The O. B. Avery Company's main office, located at 1325 Macklind St., St. Louis, will be maintained by them, where they will continue their well established service organization. The J. B. Harbison Equipment Company handle Northwest Shovels, Smith Mixers, Williams Buckets, Butler Bins and Chicago Automatic Conveyors.

A letter from The Trackson Company, Milwaukee, Wis., contains the following interesting items: Recent distributor appointments—Wm. Ford & Co., Inc., 15841 Second Blvd., Highland Park, Detroit, Mich.; Industrial Power Co., 2618 Fond du Lac Ave., Milwaukee, Wis.; Industrial Tractor Sales Co., Inc., 180 N. Michigan Ave., Chicago; Hooper Equipment Co., 523-527 E. Washington St., Indianapolis; New England Implement Co., 19 Jersey St., Boston; and 22 Garden St., Worcester, Mass. These companies handle all lines of Trackson equipment for McCormick-Deering Industrial Tractors, consisting of Trackson full-crawlers, loaders, cranes, shovels, etc. They will also carry stocks of repair and replacement parts and will be able to give prompt service to users and owners of these machines.

Municipal News and Water Works

Vol. LXXV NOVEMBER, 1928 No. 5

How Better Highway Facilities Reduce Accidents

Based on past experience 1 out of every 1,000 automobiles will be involved in a fatal accident during the next year. At this rate, if the average owner were to drive a car for 50 years, there would be 1 fatal accident for every 20 car owners during their 50 years of motoring.

It is true that two-thirds of the fatalities are among pedestrians; but the danger that the drivers and passengers incur is very great when during every year 1 out of every 3,000 is doomed to die, so long as present conditions remain unimproved.

In the early days of American railroading the accident rate was very high. But improved machinery, better management and growing caution have made travelling by rail so safe that we have ceased to regard it as being at all hazardous. Perhaps travelling by motor car will never become as safe as by rail, but it is reasonably sure that its present risk will be greatly reduced. Not the least of the means by which safety on our highways has been increased is the improvement in our highways themselves. Thus far these improvements that have had most to do with reducing hazards have been the paving and widening of roads. A narrow earth road, particularly where deep ditches or high embankments exist, is an exceedingly dangerous highway over which to travel at speeds exceeding 25 miles an hour. A little mud after a rain, or even a little loose gravel has caused many a fatal skidding. Then there is the ever present risk of a collision or of being crowded off the road. So the first important step in reducing accidents is to provide a roadway fully 20 ft. wide and to keep it as dry and clean as practicable.

The next step is to pave the roadway and to divide it into two or more traffic lanes clearly marked on its surface. This means that the pavement should have only a slight crown, for the vehicles should be encouraged to stick to their lanes. There is a tendency to crowd toward the center of a road if its crown is very distinguishable to the person driving a car.

Traffic signals on roads and streets seem destined to promote highway safety fully as much as they have promoted railway safety. Block-signalling was of inestimable value in reducing railway accidents. Stop and go signals and wig-wags at railway crossings will undoubtedly do for highways what block-signalling did for railways.

Widening, paving, traffic-laning, signalling—these are the four great means by which the highway engineer can best promote safety on our roads and streets. But this all calls for money in no niggardly sums; and the needed money can be raised only by making the public see that it pays to secure greater safety in this manner. A false sense of forthcoming security as a result of passing more stringent road laws, or as a consequence of public education in carefulness, may lead the public to postpone adequate widening, paving and signalling.

The average careless driver will always remain careless. This, at any rate, has been the experience of street-car companies with careless motormen; they never reform. Hence educational campaigns to secure greater carefulness at best will be very inadequate.

As for road laws, we have had them in superabundance for 30 years, and they have accomplished very little in promoting safety. About half the population will have to be hired as traffic-cops to watch the other half if general obedience to road laws is to be secured; and then the traffic-cops themselves will break all speed laws, just as they do now. Accident reduction by police activity has been a failure, except in very congested areas.

Is the Simplicity of Nature a Myth?

When a searcher for the causes of a phenomenon is balked, his customary cry is that there is an unusually great complexity of forces involved in producing the effects under investigation. Yet, time after time, a later and successful student of the same problem has shown that the assumed complexity was imaginary.

One of the most striking instances of this sort was the simplicity of the planetary system as disclosed by Newton. The prior Ptolemaic theory of epicyclic motions of the planets had resulted in a perfect maze of cycles and epicycles.

A few years ago an author of a book on thermodynamics predicted that no general theory of heat transfer would ever be derived, because the large number of factors involved rendered the problem too complex for deductive mathematical treatment. His book was hardly off the press when it was discovered that nearly all the seeming complexity of the problem was due to ignorance of the existence of one important factor, namely the films of quiescent gas and fluid that adhere to all solids and themselves act like conducting solids of exceedingly poor conductivity.

About the same time another book author was bewailing the complexity of the "price level" problem, in which he thought there were nearly three dozen factors. He, too, was wrong, for it was found that with only four independent variables a price level formula could be deducted that admirably fits the facts as far back as available data exist.

Early scientific researchers usually believed in the "simplicity of Nature," and stubbornly refused to allow seeming complexities to dismay them. They were right, if we may judge both by their successes and by the subsequent history of scientific progress. Complaint about complexity is a poor alibi for not being present at the discovery of a law of Nature. Rather let the investigator hold to the theory that if any one of three forces involved in producing an effect is unknown, there is likely to seem to be a complexity that is really nonexistent.

In this connection we may add that the customary training of students is very defective in that all the factors needed for the solution of a given problem are

usually set before the student who is assumed to have learned how to reason if he can deduce a correct answer. But in the problems of life, whether in economics, in engineering or in pure science, the great difficulty consists first, in securing all the necessary data, and, second, in eliminating all facts that are not of importance. Here it is that resourcefulness, thoroughness, persistence and proper methods of thinking are called for, and just here is where the average man fails.

Perhaps we moderns are still almost as greatly deluded as were the ancients in believing that the ideal method of thinking is the deductive method of Euclid. To be able to handle equations with facility, whether in the geometric or in the algebraic fashion, is highly desirable; but it is quite as important to know what quantitative data to use as it is to know how to use them when secured. There is therefore a special branch of logic (or rather there should be such a branch, for no book on logic contains more than a hint about it) that relates to the methods employed by successful researchers.

When this somewhat new term, researcher, is used, probably the average person thinks of genus, homo; species, genius; but we mean any man engaged in solving any original problem, instead of merely copying the other fellow's solution.

In short, our plea is for more and better training in the art of attacking problems the data for which must be secured and selected by the student.

Why Taxes Should Rise with National Productivity

Never a tax-budget season rolls around without its budget of editorial condemnation of the rising taxes. Yet a bit of economic analysis serves to show the fallacy of much of the editorial argument.

There are three classes of plant (i. e., tools and structures) namely: (1) Those individually owned. (2) those owned by business corporations, and (3) those owned by the public. In many instances these plants are interdependent. They are really parts of one economic unit in which the ownership of the parts is vested in different persons, business corporations and cities. For example, an individual owns a motor car, a corporation owns a gasoline filling-station and a city, county or state owns a pavement. These three parts of a plant whose function is transportation are operated under three different ownerships, but they all cooperate to produce one thing—transportation. Now let the individual family operate two cars where formerly it operated one, or let a family that had no car buy one; then since part of the transportation plant has been increased there must follow some increase in the use of the other parts—the filling-station and the highway. Let such an increased use be considerable and there should follow either an increase in the number or size, or both, of the remaining parts of the transportation plant. This would occur automatically and quickly if the ownership of all three parts were vested in one person having even meager economic judgment. But, as it is, the owner of the highways, the public, is usually somewhat indifferent to a proper increase in highway facilities, and is repeatedly urged to keep taxes down. Keeping taxes down results in inadequate development of highways wherever steady increase in motor car mileage is occurring. Yet the very editor who snails swearingly along on Sunday over congested streets often writes an editorial on Monday condemning the city council for having increased the tax rate 5 mills. He simply has not learned to view the transportation problem as a whole.

What is true of transportation is true, in large measure, of nearly every other function that a city, county or state has a hand in performing. Education is a good example. Not only are more children attending schools, but better education and a better educational plant are demanded as our average income increases. The "little old red school house" is almost as archaic as the log cabin where Lincoln was born. We can't have fire-proof, roomy schools for an increasing number of students at the same tax rate that prevailed in Lincoln's day. That is apparent. It should be equally apparent that if we continue to progress industrially, we shall continue to increase the per capita cost of schooling. Hence the per capita school tax must increase.

Not a generation ago typhoid was one of the most prevalent diseases. Now it has all but vanished in America, mainly because of chlorination of city water. Chlorination itself adds but slightly to the cost of water, but to make it most effective the water should never be turbid. This often leads to filtration and other treatment of the raw water, which is expensive. With the growth of cities it is usually necessary to go farther afield for water, and at added cost. Where the average city family indulged in only one bathroom a few years ago (many had none) it is not uncommon now to see two bathrooms even in small homes. In fact a bath tub and a shower for every bed room is already the thing desired by almost every family that can afford it. This means an increase in water consumption, and therefore in the investment in water works.

But with increased use of water there must be a larger sewer system. Then, too, instead of putting up with frequently flooded streets, the public calls for storm sewers. Finally, the pollution of streams by sewage is becoming so objectionable that sewage treatment plants are required. Thus sewer systems and taxes therefore, grow. But the daily paper editor who sees only the 5-mill increase in the tax rate, and does not consider the causes, writes his blue-Monday editorial condemning the city administration for its extravagance.

Incidentally we are all a great lot of condemners of what the other fellow does, if our living expenses rise in consequence. We forget that our income has also risen, and solely because of industrial progress, some of the fruits of which are more automobiles, more schools and teachers, larger and better water works and sewers, wider and better streets, better playgrounds and parks.

We have heard that Chinese editors never complain about increased taxes, but the Chinese have no water works, sewers, roads or schools worthy of the name. So if our tax disgruntled editors want real and permanent relief, let them join their fellow literary artists in Mongolia or thereabouts.

H. P. Gillette

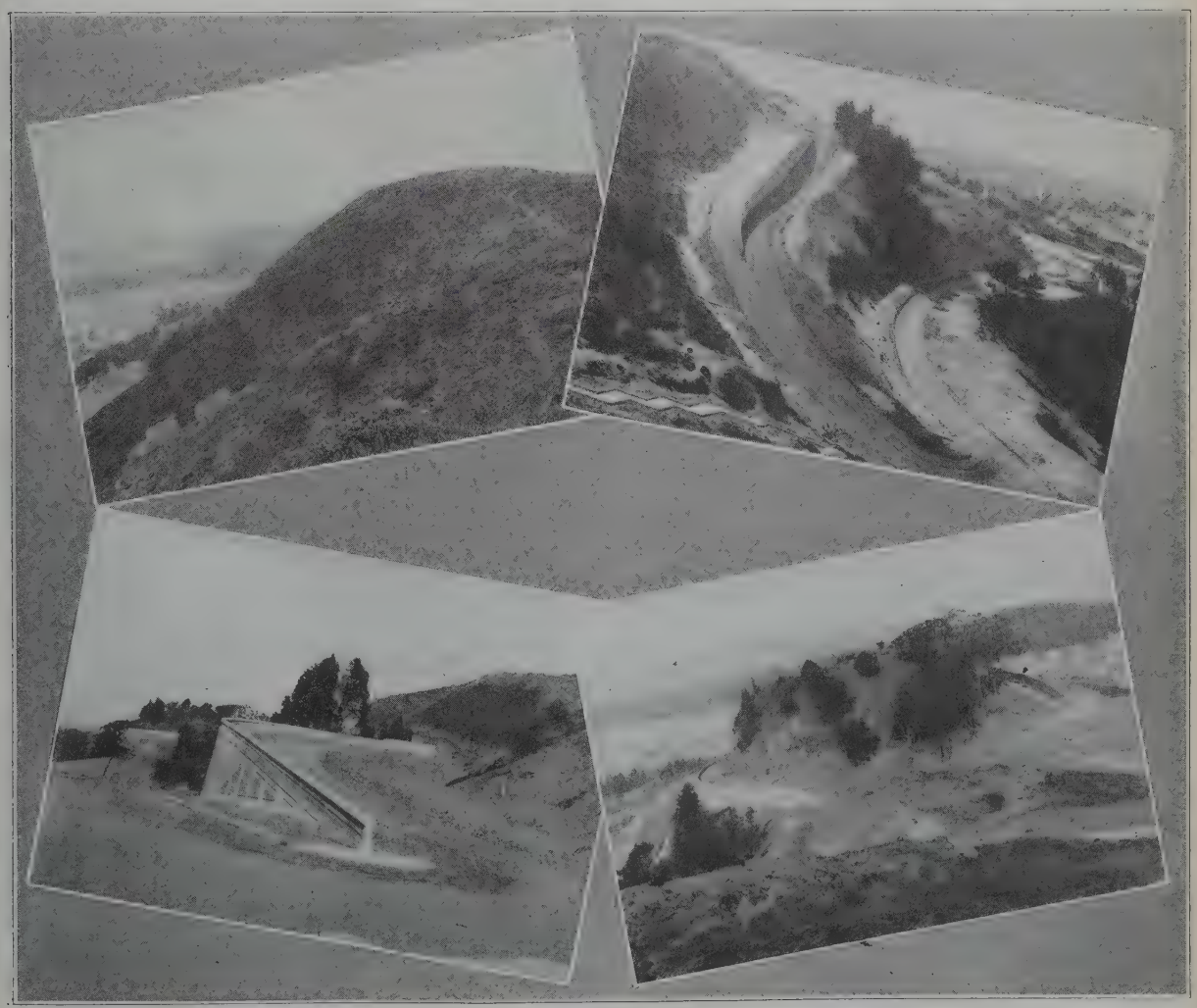
Transforming a Hill Into a Residential Tract

CONSTRUCTION is now under way on the Goldern Gate Heights improvement at San Francisco, Cal., one of the largest special treatment improvements ever undertaken by the Department of Public Works. In passing it may be noted that in San Francisco improvements distinctly local in character but requiring more than the ordinary treatment of local street improvements, such as double roadways, retaining walls, stairways, ramps, etc., are known as special treatment improvements.

The Goldern Gates Heights contract also was distinctive in being the largest public contract awarded by the city for street improvements to be assessed upon the property improved under the Street Improvement Ordinance regulating public assessment on street improvements. This improvement was somewhat in the nature of a residential tract development as it included the grading and macadamizing of streets and construction of walls, stairs, etc., of a complete and distinct residential district, with the construction of sewers and permanent pavement, but differs from the usual residential tract development, as generally recognized, in that the property involved was already subdivided and under individual ownership and was not being developed primarily for the purpose of selling lots.

The accomplishment of this contract marks the successful culmination of the efforts of the department to make an otherwise inaccessible and practically worthless hillside district available and useful for residential purposes. Through mutual agreement between the city and the property owners, all the property was temporarily deeded to a trust company. Meanwhile the department planned new easy grade, circuitous streets over the hillsides to replace the steep and impracticable streets of the existing gridiron system and rectangular blocks; and also re-subdivided the property for return to the original owners, who received deeds for the new areas in exchange for their previous holdings.

The present contract, approximately estimated at costing $425,000, includes grading of 4½ miles of streets, with 900,000 sq. ft. of macadam surfacing, necessitating over 335,000 cu. yd. of excavation and construction of 7,600 cu. yd. of reinforced concrete and rubble walls. The contract covering grading and macadamizing has been completed and sewer construction is now in progress. The work is being done under the direction of the Bureau of Engineering, of which M. M. O'Shaughnessey is City Engineer.



Various Stages in the Goldern Gates Height Special Treatment Improvement of the Department of Public Works of San Francisco

Twelve Mile Paving Project Involving Viaduct and Bridge

Notes on Methods Used by the Various Contractors on Lawrence Avenue

AS PART of the present main highway plan now under construction to afford motorists of Chicago easy and rapid access to outlying State highways leading to various points of importance, one of the interesting jobs now under way is the extension of Lawrence Avenue westward from the city limits to the county line. The new highway will be of reinforced concrete, 20 ft. in width except for intersections, where the width will be 40 ft., and involves the construction of two major structures. These structures are a skew girder type bridge over the Des Plaines River, and a viaduct under the Soo Line tracks. Interesting methods were revealed by a recent visit to the paving, the bridge job, and the viaduct excavation work.

Industrial Haulage.—The paving operation is based upon an industrial haulage system, with batch boxes and batch box cars hauled by gasoline locomotives. This has worked out well even though the same organization and plant was used to pave an intersecting highway, Cumberland Ave., as part of the same general project. Relaying of the track from the intersection of the two streets so as to serve the paver on Cumberland Ave. afforded but little trouble, and made it possible to pave a still greater yardage from the same batcher plant setup than would have been possible should this other street have been paved at a different time. About 12 miles of highway had to be paved with this plant, and work progressed in a very satisfactory manner.

Proportioning Plant.—The proportioning plant was located along the Soo Line tracks about two blocks from the road being paved, with the space between the actual plant and this intersection made available for various job purposes, such as for offices, blacksmith shop, tool shed, gasoline pumps, equipment storage, material storage, and other necessary things.

Aggregate Handling.—Cars of aggregates were delivered to a team track at the plant, and were unloaded to stock piles by a 15T Browning locomotive crane equipped with a 1¼ cu. yd. clamshell bucket. A 2,000 gal. elevated tank erected at this point was used to supply water for this crane, the tank being filled from the pipe line laid for the paving operations. On the opposite side of the stockpiles, and midway between them, two 40 cu. yd. Johnson steel bins were erected for batching purposes. One bin supplied sand and the other stone. These bins could be loaded either from the cars or the stockpiles by the locomotive crane.

Cement Handling.—Cement was delivered to the team track in box cars, and a loading platform was erected alongside the tracks so that the cement could be carried from the car and loaded onto the batches. The industrial trackage was laid in this yard so that the batch boxes could be loaded with cement and aggregates in an expeditious manner and taken out onto the main line leading to the paver with minimum switching. A four ton locomotive was used in this yard to spot the cars through the batching process.

Yard Crew.—The men required at this plant included the following:

1 Crane operator
1 Fireman
1 Locomotive operator
1 Loader
4 Cement hands on platform
1 Sack laborer
2 Cement hands in car

Hauling Equipment.—Besides the 4-ton locomotive used for switching purposes in the yard, the contractor used an 8-ton gear drive Plymouth locomotive for hauling trains to and from the mixer and a 7-ton locomotive spotting cars at the paver. Batch boxes are mounted two to the car, and 26 cars or 52 batches to the train. Angle irons riveted along the sides on the bottom of the batch boxes engage the car frames and prevent dumping loads on rough track and curves. A timber pile bent trestle was erected over the river to afford access to the paving east of that point. Batches were dispatched to the mixer at the rate of 8 trains a day. The train crew consisted only of a locomotive operator. The maximum haul was 5 miles, and at the time the work was visited the haul was approximately 3 miles. Water was secured from the Des Plaines River, pumping from a small intake channel dug for the purpose, and pumping with a 3-cyl. 4 cycle C. H. & E. gasoline driven pump through a 2 in. pipe line. The hose connection to the mixer was 1½ in. in diameter.

The Subgrading Equipment.—Subgrading was done with a French subgrader, slips, and light roller. The road forms were set after grade was prepared by a Carr form grader.

Paving Equipment.—The batches were mixed in a 27-E Koehring paver equipped with a crane for handling the batch boxes, and the concrete was finished after puddling by means of an Ord tamper, and after belting and edging the slab was covered with wet burlap for the first night, and in the morning the burlap would be removed and calcium chloride spread on the surface to afford further curing. The actual mixing and handling of the concrete was done with the following force:

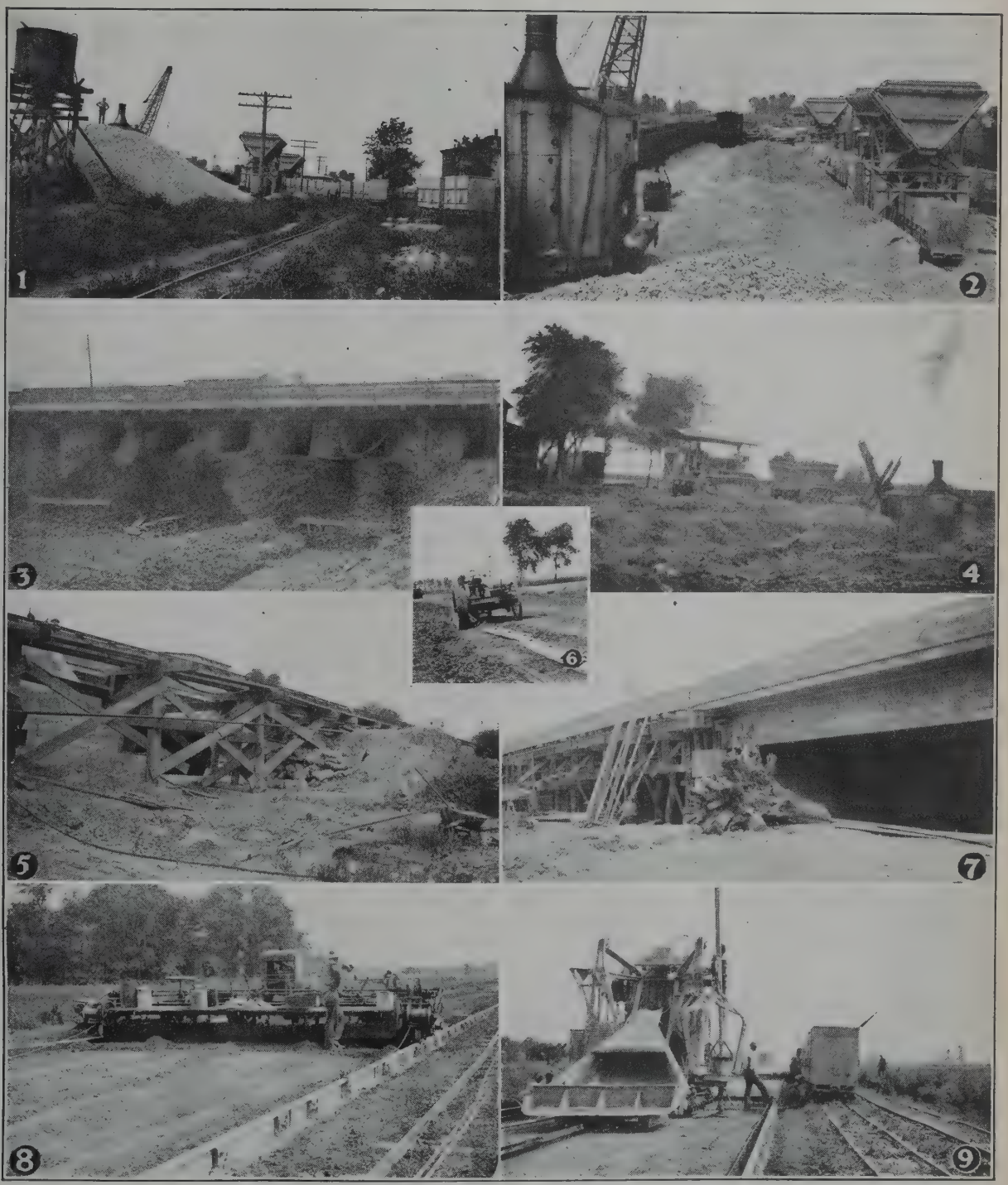
1 Foreman
1 Operator
1 Hoist man
2 Dumpers
1 Finishing machine operator
3 Puddlers
2 Finishers
2 Burlap and chloride men

With this organization and equipment, the contractor was able to lay 20 ft. Illinois Section pavement at the rate of 900 to 1,000 lin. ft. per 8 hour day, although sometimes a little overtime was necessary to reach that figure, from one cause or another.

Bridge Construction.—As already mentioned, the work involved the construction of a bridge over the Des Plaines River. This structure, similar to one erected at the same time about a mile to the South, and described elsewhere in this issue, was a skew girder type reinforced concrete highway bridge with Flemish bond face brick handrails, with a 44 ft. roadway and two 5 ft. sidewalks, designed for a uniform loading of 125 lb. per sq. ft. This bridge is supported by concrete piers and abutments, with concrete wing walls, resting on spread footings bearing on clay.

This bridge has a total length of 174 ft., with three spans. Essentially the same as the bridge downstream, it was built in 3 months and 4 days, with the exception of the handrail, a much shorter time than was required for the construction of the other bridge, built under the same conditions in general.

The contractor on this bridge used a very much simpler plant. In this case, the aggregates were dumped on the subgrade from motor trucks, at convenient places along the fill. On the same bank of the river, the west bank, a 2-bag Smith mixer was set up on a low platform and ramps laid to each side. The aggregates were taken to the mixer in wheelbarrows, and concrete was discharged directly from the mixer into buggies for distribution to the forms. Hollow tile were used as filler material under the sidewalk slabs. Piers and abutments were constructed after wooden cofferdams had been constructed on shore and towed to position and sunk in place. These cofferdams were constructed of 2x6 T & G lumber in 10 ft. lengths. Excavation was all done



Views of Paving and Structures on Lawrence Ave. Job.

1.—General View of Batching Yard. 2.—Closeup View of Crane, Stockpiles, and Batchers. 3.—Opening Drifts Under Tracks for Grade Separation. 4.—Tractor and Trailer Outfit Moving Dirt from Shovel Cut on Grade Separation. 5.—View of Temporary Bridge Built for Batch Box Railway Over Des Plaines River. 6.—Carr Formgrader on Subgrade. 7.—View of Bridge With Some Falsework in Place. 8.—Subgrader Preparing Final Finished Subgrade. 9.—Paver, Batch Boxes, and Finishers at Work

by hand. Falsework to support the work was built up of pile bents, each carrying a load of 12 tons. A total crew of 27 men was required, including carpenters.

With this organization and equipment, the contractor could mix and place about 120 cu. yd. of 2,000 lb. per sq. in. 1:2½:4 concrete per day. It may be readily seen that the equipment charge against the job was done to the minimum, but that labor costs would be higher.

Viaduct Job.—The other important structure on the project is the new viaduct under construction to provide a grade separation at the intersection of the highway with the Soo Line tracks, about two miles west of the river. Here a general contractor and two subcontractors were found doing their work in an interesting manner.

The approaches to the actual trackage were excavated by a 31-B Bucyrus shovel loading into motor trucks and into Dump Trailers on crawler mountings, each of 8 cu. yd. capacity, and two hauled at once by a Caterpillar 60 tractor. This latter equipment, hauling with a round trip distance of about 1,000 ft., could make a round trip, thus moving 16 cu. yd. of dirt, in 17 minutes. Between trips of this crawler equipment, the shovel would load into the motor trucks. A La Plante-Choat hydraulic bulldozer mounted an a Caterpillar 30, served at the dump, making ordinary fill along the railroad.

Hand Work Under Tracks.—Since the work had to be done without interfering with the operation of the railroad in any way, different methods had to be used to remove the dirt under the tracks. Piles were first driven between the ties, and formed into bents by trenching in the ballast and spiking timbers from pile to pile, so as to form a trestle to carry the tracks. Eight drifts were then opened up through the dirt under the tracks, after the approach excavations had progressed sufficiently. These drifts were mined between bents by hand, with the men loading the dirt into wheelbarrows and wheeling it to the open excavation and dumping it over the edge. These drifts were widened to the piles, the amount of dirt being moved in this way being about 2,800 cu. yd. The balance of the excavation under the tracks was then done by dragline. After all excavation is completed, the viaduct structure will be built of reinforced concrete, and the railroad loadings then applied to the concrete upon the removal of the temporary pile bents. The cost of this viaduct will be shared between the railroad and the county.

Those Responsible.—The entire project was designed and built for the County of Cook, Illinois, under the direction of Maj. Geo. A. Quinlan, Superintendent of Highways, and W. E. Bates, construction engineer. The county was represented on the paving work by S. L. Winslow, resident engineer, and on the bridge by Robt. Hoffman, engineer and Joe Kane, inspector. The paving work was done under contract by the Chicago Heights Coal Company, represented by Thomas Peters, superintendent, while the bridge work was done by the Mohawk Eng. & Const. Co., contractors, represented by Swan Johnson, superintendent, and the viaduct work was done by the Great Lakes Const. Co., general contractors, represented by J. B. Shields, engineer, who sublet some of the work to H. H. Embody and Thomas McQueen, two well known excavation and grading contractors of the district.

The work was done under the standard specifications of the County Department of Highways.

Curing Concrete Pavement Without Water or Dirt

A new method of curing concrete pavement that has recently come into extensive use in California and other western states, consists of the application with a spray gun of a bituminous paint immediately after the concrete pavement has been poured and belted. The principle of the method is that there is sufficient moisture in newly poured concrete to effect a perfect cure if the moisture can be kept from evaporating. The bituminous paint is claimed to completely seal the surface of the concrete and prevent the evaporation of the original mixing water. This method eliminates all use of earth and water, burlap, sprinkling or straw. It is further claimed that it permits the use of the street or highway by pedestrians within 2 days after the concrete is laid; by light automobiles within 7 days and by heavy traffic within 12 days. This method of curing is known as the Hunt Process, and the coating applied is known as the McEverlast Paving Special. This is composed chiefly of "processed" Trinidad Lake asphalt, Bermudez asphalt and Gilsonite blended at an extremely high temperature. It is used cold and applied without artificial heat. Over 15,000,000 sq. ft. of concrete pavement had been cured by the Hunt Process up to June 1, 1928, and contracts for curing an additional 10,000,000 sq. ft. had been signed. The Hunt Process was developed by, and is being handled by the Everlasting Paint and Sales Co., Los Angeles, Calif.

Tokyo to Have 100 Miles of Streets.—The city of Tokyo, Japan, has announced a street paving program for the next seven years which will provide about 100 miles of new paved streets and establishment of five large bus stations to accommodate an additional 700 municipal owned busses. A special loan will be made to secure the required funds.

Air-Rights and Tomorrow's Roads

Something new in highways is forecast in the announcement that Atlantic City and Philadelphia are to be connected by a $50,000,000 double-decked steel and concrete elevated roadway—construction to commence early this fall, according to "The Magazine of Business."

The roadway, said to be backed by the Pennsylvania railroad and other interests, will replace the electric lines now operating between the two cities, will be 70 ft. wide in two decks, and will have three traffic lanes in each. The electric-line tracks will be used for freight. The first deck of the roadway will be used by the railroad for a new high-speed gasoline and electric car.

The upper deck is to be used for automobile traffic. Tolls for the use of the road will also carry the right to use the company garage to be built in Atlantic City, the largest of its kind in the world.

This privately owned project for an elevated high-speed automobile highway is of special significance because of pending development of air-rights over railroad right-of-ways in many of the country's centers of population.

Bicycle Lanes on French Highways.—According to H. C. Schuette, U. S. Assistant Automotive Trade Commissioner at Paris, France, the construction and maintenance of the numerous bicycle lanes ("trottoirs cyclables") that skirt the edge of a great number of French highways will be revived in the near future as a result of the new resources the Minister of Public Works is expected to divert to this purpose. The importance of repairing these lanes, long neglected because of a lack of funds, is measured by the fact that there are more than 7,000,000 of these vehicles in France, supplying the transportation needs of a large number of inhabitants. Realizing their need for repairs, the Touring Club de France has taken considerable interest in this work, and it is expected that construction of new "trottoirs cyclables" and the repairing of many old lanes will go forward very shortly. It is reported in France that the Minister of Public Works can use his own discretion as to what portion of the highways funds are to be used for this purpose. Although the Minister of Public Works can indicate the lanes which are in greatest need of repair, all maintenance and construction is in the hands of the chief highway engineers of each department, who are, in turn, under the supervision of the various state governments.

Public Purchase of Materials for Public Works to Be Furnished to Contractors

A Report by the Municipal Research Bureau of Cincinnati, O.

THE information contained in this report is taken from replies received to inquiries made by the Bureau under date of July 26, 1928. The letter of inquiry, accompanied by a reply form for the use of those who found it more convenient than a letter, was sent to the state highway commission or corresponding authority in each of the 48 states, to 35 county engineers, or corresponding officers, in as many of the larger counties in the United States, and to 90 city engineers, including all those of cities of as many as 100,000 population, except Cincinnati. Replies have been received from 41 states, 24 counties, and 62 cities. This report is derived from replies from jurisdictions where the practice under inquiry is in use, has been used and abandoned, or has been contemplated and not adopted. Those reporting purchases, but indicating further that the purchased materials are used by direct labor, and not supplied to contractors, have been treated as negative responses to the inquiries. A number of negative responses indicated that legal and financial requirements would not permit the practice.

Extent of Practice—by Jurisdictions

State.—Twenty-one states—if Alabama be included—report that they now furnish some material to contractors. Of the twenty-one, two resort to it in special and exceptional cases only, one expects to abandon, and one reports it as diminishing; one furnishes material of which about one-half is a state product, and another requires contractors to purchase a state product.

Another state, from which no direct report was received, is said by one of the county reports to furnish portland cement.

Another state, not included among the twenty-one, takes bids in behalf of contractors who are then permitted to purchase directly at the prices obtained and guaranteed by the state.

Two states, among the twenty-one, have abandoned the practice as to certain materials while continuing it as to others.

Four states report complete abandonment of their former practice. Two report that they have considered the matter and declined to adopt the practice.

Counties.—Five counties report that they now furnish some material to contractors.

Another reports that it was used upon special occasions.

Another reports that it purchases certain materials for repairs only. It is not certain from this answer whether these repairs are made by contract or by the direct employment of labor.

Three report the abandonment of the practice entirely, and one of the five reports a diminished use of it.

One state highway commission wrote that two unnamed counties, from which the Bureau did not inquire, follow the practice.

Cities.—Thirteen cities report that they now furnish some material to contractors. Of these thirteen one does it in special cases only, one very rarely.

One tried the method once and found it successful.

Two cities take bids and guarantee prices to contractors, as described of one state.

Four cities which formerly used the practice report its complete abandonment.

Two of the thirteen cities use the practice as to fewer materials than formerly.

Extent of Use—by Materials

The material which figures most extensively in the experiences reported is portland cement. The materials upon which the results of experience are most nearly uniform are culvert pipe, and sewer pipe and castings.

But it should be said that as to the items last named the Bureau inclines to believe that the practice under discussion is more widely followed than the replies indicate. The reply form did not specifically mention them, and in some cases the authority furnishing the reply may not be in direct contact with sewer work. (See Tables I, II, and III.)

Administrative Methods

Basis of Contractor's Bids.—Most of the authorities which furnish materials require contractors to bid upon the basis of using materials furnished. A few allow the contractors to submit bids upon the basis of using materials furnished by themselves, or upon both bases.

Quantity Basis of Purchases.—Relatively few responses were received to an inquiry whether purchases were made on the basis of requirements for a year, a season, or each project. However, six states and five cities reported using the yearly basis; one county uses the season basis; and five states and a county the project or job.

Delivery Arrangements.—Such reports as reply to inquiries as to delivery arrangements are all alike in

Table I.—Extent of Practice of Purchasing Materials to Be Furnished Contractors for Use in Public Works—By State Highway Authorities

	General	Portland Cement	Aggregates	Asphalt	Culvert Pipe	Gravel Surfacing	Reinforcing Steel	Miscellaneous	Paint	Bridge Material
Alabama		1		1	1					
Arkansas						1				
California		3	3		1			1		
Colorado	3									
Connecticut		1		1	1					
Delaware		3	3							
Illinois		1								
Indiana		1							1	1
Iowa	8									
Michigan		1.2								
Minnesota		13								
Mississippi						1				
Missouri		1	1						1	
Montana		3								
Nevada					1					
New Hampshire				4						
North Carolina		1			1					
Oregon		3								
Pennsylvania	5									
Rhode Island				1	1					
South Carolina	5									
South Dakota		6			1			1		
Tennessee		1	1	1						
Utah		1			1		1		1	
Virginia		1								
Washington		7								
West Virginia		8								
Wisconsin		3								
Wyoming					1					1

Key: 1. Purchases in market and furnishes to contractor.
2. Furnishes state product.
3. Abandoned practice.
4. Intend to abandon.
5. Practice considered and not adopted.
6. Requires use of state product.
7. Contractor purchases at prices secured and guaranteed by authority.
8. Special cases only.
9. Practice is diminishing.
10. Repairs only.
11. Laws do not permit.
12. Rarely.
13. Reported by Ramsey County.
14. One occasion only.

Table II.—Extent of Practice of Purchasing Materials to Be Furnished Contractors for Use in Public Works—By County Engineer

Counties	General	Portland Cement	Aggregates	Culvert Pipe	Gravel Surfacing	Joint Material	Bridge Material	Asphalt
California								
Los Angeles							1	
Illinois								
Cook		1						
Kansas								
Sedgwick	3							
Michigan								
Wayne		1	1			1		
Minnesota								
St. Louis				1	1			
Oregon								
Multnomah		14						
Pennsylvania								
Allegheny		3						
Texas								
Harris					1			10
Washington								
King		1						
Wisconsin								
Milwaukee		3						

KEY: See TABLE I

indicating that vendors deliver at or near the site of the job. If any jurisdiction purchases and stores, the circumstance is not disclosed by these replies.

Workmanship, Etc.—Inquiries as to waste of furnished materials, and as to the ease or difficulty of securing the use of the full amount of material required and of securing satisfactory workmanship, produced a number of replies, a few of which report no difference, and most indicated some greater ease in these particulars as against construction wherein the contractor furnishes all material.

Disadvantages

Not all the authorities which have abandoned the practice under discussion have done so by reason of very positive disadvantages. Some of the particular difficulties which arose in particular cases do not go to the general merits. In a few cases no disadvantages appear to have figured in the discontinuance. In others it was rather the apparent absence of either advantage or disadvantage that led to the discontinuance. And it should be noted that in a number of jurisdictions the practice is retained for certain items after its abandonment as to others.

The most vital disadvantage appears to be in the difficulty of securing timely deliveries. Several reports mention that in such case the authority has to bear the responsibility for delay, and even to indemnify the contractor for his losses caused thereby. This difficulty does not appear to figure with those who continue successfully to use the method.

Akin to that difficulty is another, the annoyance of the responsibility for materials furnished, and the additional clerical work involved.

Advantages

The outstanding advantage cited by authorities which do furnish material is the saving in money cost. This is achieved by virtue of purchasing in greater quantities and at more favorable times than could be done by one contractor; by trade and cash discounts; by transportation cost differentials; by tying up less of the contractor's capital; by avoiding the margin which the contractor would add to his costs for the same material; by using state products; etc. The amounts of such savings reported are not susceptible of summary statement or comparison; interesting statements in particular cases are given in Section VIII of this report. And it should be noted that in other cases the reports declare no savings are made at all.

In the case of sewer pipe, castings, bridge material, etc., it appears that the additional advantage of timely and proper delivery is generally obtained, to a greater degree than when the contractor furnishes the material.

In addition, certain authorities are of the opinion that they more surely obtain the use of good materials in the full amount, better workmanship and better inspection, when certain materials are furnished.

Table III.—Extent of Practice of Purchasing Materials to Be Furnished Contractors for Use in Public Works—By Cities

City	General	Portland Cement	Brick	Wood Block	Paint	Sewer Pipe, Etc.	Castings	Water Works Material	Bridge Material
Camden	8								
Charleston			14						
Chicago								1	
Cleveland	5								
Dayton									
Detroit		3	3	3		1			
Flint		1							
Grand Rapids	12								
Houston								1	
Jacksonville						1	1		
Los Angeles		3							
Memphis						1			
New Orleans	11								
Norfolk					1			1	
Pittsburgh							1	1	
Providence		1	1			1			
Reading		14							
Richmond		1	1						
Rochester		14							
San Antonio		3							
Seattle	7								
Spokane		7							
Wichita		3	3						

KEY: See TABLE I

Related Methods Reported

The practice reported by the State of Washington and the Cities of Seattle and Spokane, therein, appears to be designed to secure any price advantage to be obtained by the exercise of the larger purchasing power of consolidated contract requirements, without incurring any administrative difficulties inhering in the actual handling of material. The contractor is guaranteed that he may procure material under the bid accepted by the public authority, and bids upon that assurance. The supplier has the assurance of a volume of business which enables him to bid well.

Excerpts from Individual Reports

While the bulk of the material digested in the preceding sections is too great to permit transcription, a number of items appearing in various reports are sufficiently illuminating to warrant presentation.

The excerpts which follow are not selected as typical and do not present a composite of all replies. Rather they illustrate particular local situations, and include more nearly all the unfavorable replies than the favorable. In several cases they reveal difficulties not reported elsewhere, the roots of which are not apparent to the stranger.

For full information as to the practice of each authority, consult in each case the tables.

Alabama State Highway Department.—Gets dealer's discount and cash discounts, as contractors are not always able to do. Also, "We operate 12 camps that use convict labor and purchase all cement, aggregates and other construction materials as well as equipment for them."

California State Division of Highways.—"California highway construction began in 1912, and during the early part of construction the Highway Department furnished all of the cement, part of the aggregates, all of the corrugated culvert pipe and a few other

minor items. A general agreement was entered into with the several cement companies but separate quotations were received for each individual road contract. Contractors for large quantities of concrete aggregates were entered into with several companies, the material to be delivered as called for. Competitive bids were received in the purchase of corrugated culvert pipe, the contract being for a year's supply and based on approximate quantities. At that time, the State Highway Department had preferential rates on the railroads. During the war when the U. S. Government took over the operation of the railroads, the preferential rates were cancelled and have not been re-established. At the same time, the Government fixed a price for the Government purchase of cement, and coincident with it, the price to the State jumped very decidedly.

"More recently, the State has abandoned the supplying of cement and aggregates to contractors, but it still supplies the corrugated culvert pipe, expansion joint material and some minor items. These are purchased for each job separately by the Purchasing Department, based on competitive quotation.

"There is no financial advantage in this manner of handling these materials, but it does give a better control of the kind used."

Colorado State Highway Department.—Abandoned the practice. Disadvantages with delivery, with waste of material. "The practice gave the contractors just another opportunity to wrangle and present claims for delay."

Delaware State Highway Department.—"During the war as an emergency measure we did furnish cement and stone for a period of about a year. Since then we have abandoned this practice, believing that better prices are secured when materials are bought by the contractors from commercial sources."

Illinois Division of Highways.—"Each year the Department enters into contract with the cement companies for furnishing enough cement to carry on the year's construction program. We feel that this system has several advantages and have found the practice satisfactory after several years' experience."

Indiana State Highway Commission.—"We doubt if there is any difference in the quality of workmanship secured because of either method of obtaining cement for use on a contract. The only disadvantage of the purchase of these materials that we have become aware of is that we must bear the responsibility of furnishing satisfactory materials to the contractor, and when the cement fails to pass the necessary tests, as it will occasionally do, we are in a rather difficult position.

"We believe that there are advantages which consist largely in the fact that the contractors are not obliged to have a large working capital invested in cement when we require them to store a considerable amount. It may be possible that there is some saving because of our quantity purchases, although sometimes we have been rather doubtful. We do not believe that we obtain any better materials, construction or inspection because of this practice."

Michigan State Highway Department.—"We have not nor do we intend to consider the furnishing of any other materials. Our reason for the furnishing of cement is particularly due to the fact that we manufacture approximately 50 per cent of all cement needed at our own plant. The balance of our requirements are obtained from other mills located within the State. The advantages are that this ties up less of the contractor's capital, results in a saving of perhaps 2½ ct. to 5 ct. per barrel, permits more satisfactory inspection service and makes possible a further saving of 10 ct. per barrel cash discount and 10 ct. per barrel trade discount."

Missouri State Highway Department.—"We furnish aggregates whenever trouble in deliveries might be anticipated by contractor. . . . There is no difficulty of timely delivery; if properly handled can give better service due to elimination of hogging of orders by certain producers over their production capacity." One disadvantage of the practice is that it "tends to reduce items on which contractors can figure profit."

Advantages are "difficult to estimate. We have handled large quantities and contracts involving very large savings, frequently $10,000 to $15,000 and in some cases as high as $100,000. We save from 10 to 20 ct. per barrel on all cement. Believe we could easily show a saving of upwards of $500,000 during past 3 or 4 years."

Nevada State Highway Department.—"During the past year this department has purchased corrugated metal pipe, furnishing it to the contractor and requesting bid from the contractor for installing. We estimate a saving to the State of $10,985.44 during the past year on this one item.

"By furnishing corrugated metal pipes we have encountered no difficulty in delay of pipe, the contractor having been held up at no time on account of non-delivery of pipe. We find that the culvert companies have been able to quote a lower price, as they receive payment from the State within 30 days after delivery. In most instances when pipe is purchased by the contractor, payment is held up for from two to six months."

Rhode Island State Board of Public Roads.—"It is the practice of this department to require the contractor to furnish all materials excepting culvert pipe, and asphalt for bituminous macadam. The reason we furnish culvert pipe for the different contracts is to avoid delay in starting the work, the laying of the culverts being one of the first operations. Pipe for culverts is ordered well in advance of the awarding of the contract so that they can be made up in the proper lengths and the installation stations marked upon same. The manufacturer then holds them for further shipping directions. As soon as the contract is awarded the pipes are ordered shipped and when they arrive are immediately unloaded by the contractor and deposited at the proper location along the road as per the stations marked on the pipes. Several concerns who manufacture pipe which meets our specifications furnish us seasonal prices for their products, which price includes freight delivery to any point within the State. There is little or no difference in these prices.

"In the case of asphalt, we require storage control, and as there are only two refining companies within the State furnishing asphalt for road purposes, namely, the Standard Oil Company and the Texas Company, both of which companies have refineries in Providence and East Providence, we purchase the asphalt directly from them. During the construction season our laboratory engineers make daily tests on the road asphalt in the storage and in the intermediate tanks of both of the above concerns, which insures our getting a uniform product in accordance with our specifications on all our contracts. Again, the basic price on asphalt is the same and we more or less even up the business between the two concerns. Note: If we allow the contractor to furnish asphalt in accordance with our specifications, it opens up the field to brokerage concerns and the possibility of having inferior material shipped in to the State for the jobs. Before the material can be used it will have to be tested and if not found up to specifications rejected. This causes a hardship on the contractor and seriously delays the work.

"In the case of cement which is furnished by the contractor we require the contractor to notify us in advance of the concern from which he is to purchase his cement. We then make arrangements with outside testing laboratories for pre-testing the cement at the source of manufacture. In the case of mineral aggregates—sand, gravel and stone—our laboratory has pretty well covered our own State and we furnish the contractor with considerable information concerning available materials within the State. On out-of-State material, such as Connecticut trap rock or Long Island Sound sand, we are in constant touch with this material and run frequent tests on the same.

"Materials furnished the contractors are not seriously wasted. In the case of pipe there is no chance for wastage, while in the case of asphalt the same is practically true. On rare occasions a truck load of asphalt is lost due to one cause or another, and if the blame

rests on the contractor we do not hesitate to deduct the cost of the asphalt from moneys due him."

South Dakota State Highway Commission.—"We specify South Dakota State cement on all our work, but contractors buy it."

Virginia Department of Highways.—"We make all purchases of cement for the contractor for all construction work. The price of this material is set forth in our proposal at the time the contractor makes his bid and his bid is made in accordance with these prices. We have used this same practice for the last four years and have found it to work very satisfactorily and applies to all contracts, and the contractor must bid on this basis exclusively.

"The contractor forwards his request to this office and we in turn notify the cement company, thereby having a check on deliveries. The cement company make deliveries to the railroad station or the steamboat wharf as requested. This is the only material that is furnished the contractor and we have found it very profitable as well as satisfactory."

Washington State Highway Department.—"This Department does not furnish any materials to the contractor for highway construction work. It is, however, the practice to guarantee to the contractors a price on cement at the factory. This price being effective for the life of the contract and the cement to be used on highway work only."

West Virginia State Road Commission.—"The State Road Commission does not purchase materials to be furnished to contractors, as a general rule. There have been a few exceptions. Occasionally, the Commission lets a contract for furnishing gravel to one contractor, and a contract for placing the gravel to another contractor. Recently, a contract was let for 2.97 miles of brick road. Bids were taken both ways, and a somewhat better price was obtained on the basis of the State purchasing the brick. Deliveries are to be made as required, the sources being very convenient."

Cook County, Illinois (Chicago).—"Prior to 1928, cement was purchased by the State of Illinois and furnished to the County of Cook. In view of the large program of the County for which 700,000 bbl. of cement would be required, the Board took bids and awarded a contract."

Wayne County, Michigan (Detroit).—"This Board furnishes to contractors all Portland cement, aggregates, metallic and flexible joint materials required for pavement and in all cases contractors are required to bid on that basis.

"We contract during the winter for all of the ensuing season's anticipated requirements in the above materials and the vendors are required to deliver it at such sidings in Wayne County as we may designate. We believe our plan has the following advantages:

1. It assures, without controversy, use of full amount of material required by specifications.
2. There is very little waste of materials.
3. We believe we are able to purchase those materials at considerable saving.
4. We assure ourselves of better materials as we have absolute control of inspection and are dealing direct with vendors."

Multnomah County, Oregon (Portland).—Does not purchase, but: "We purchased the cement on one job, the reconstruction of a large bridge and laying a concrete deck on same. It proved very satisfactory in that there was no question as to our getting the proper amount cement in the concrete."

Sedgwick County, Kansas (Wichita).—"It is pertinent to say that Sedgwick County, in which this city is located, bought materials for seven miles of brick highway about 1919, and then advertised for bids on the basis of material being furnished at a certain specific unit price. It developed at that time that there was a great deal larger demand for those materials than could be supplied so that dealers were being offered a premium for immediate delivery. This the County could not pay. As a result a large amout of cement shipped to the County was being sampled at the mill while still hot and rejected on that account after it arrived at its terminus. This would consume a week or ten days after which the cement would be diverted to other jobs at a premium while the County's contract was tied up waiting for the same material. This is the instance which came to our notice of the undesirability of dual management of the same construction job." (Reported by Wichita City Engineer.)

Charleston, South Carolina.—"On only one occasion do I remember that the City purchased material (in this case vitrified brick) for a contractor to use in public work. Because of its better financial rating the city obtained more favorable quotation from the manufacturer than did the contractor. The material was brought from Philadelphia by sailing vessels some of which were delayed. The contractor, for laying the brick, notwithstanding fairly tight specifications, claimed delay and a three cornered controversy ensued between the City, the contractor and the manufacturer. While the City won out, we have not tried this method since."

Dayton, Ohio.—The only experience which the City of Dayton has had in the purchase of materials to be used in contract work was about twelve years ago during the construction of the Fifth Street, Webster Street and Keowee Street Bridges. At that time, the City purchased cement and steel and it was so specified when the bids were taken that these materials were to be furnished by the City.

"Our experience at that time was that while there probably was a certain amount saved by the purchase of these materials, this saving was more than offset by the inconvenience experienced in handling the materials between the City and the Contractor. Since that time, we have always taken bids on the basis of the Contractor furnishing all the materials and doing all the work."

Detroit, Michigan.—"Previous to 1914 the City of Detroit furnished the paving brick and creosote block for new pavements. These materials were delivered to the contractor on site of the job. This practice was discontinued in 1914 on the adoption of sheet asphalt pavement as the standard for all pavements.

"Previous to 1910, the portland cement was furnished for all sewer contracts. This practice was discontinued at that time. Disputes over the returning of the empty bags and unused cement were factors that helped lead to the decision to discontinue the practice."

New Orleans, Louisiana.—"The City of New Orleans has never put this system into use having been legally prevented several years ago from supplying asphaltic mixes to contractors from its own plant. Our contracts are all predicated on a unit price basis for work complete in place, the contractor supplying his own material."

Pittsburgh, Pennsylvania. — "The principal reason for the purchase of materials by the city is to secure same at a better price, get prompter deliveries and a more satisfactory and more uniform product. Administrative work and the difficulties often encountered in municipal administration are lessened, as it is easier to secure a limited number of good inspectors than it is to secure and manage a large number of inspectors scattered over a large number of plants.

"During the current year in an attempt to secure more reliable bidders upon our contracts and to determine whether or not our practice in regard to purchase of water line castings was satisfactory, we awarded two contracts for water line construction whereunder the contractor furnished all materials. We found that it did not make any difference as to reliability of bidders as the material manufacturer apparently will sell to any bidder provided he can get a surety bond, and bidders appear to be able to get surety bonds without much regard for their qualifications and financial standing. The prices for the work did not indicate any saving as a result of the contractors furnishing the materials themselves and probably the costs are greater as the contractors naturally include a profit on the materials purchased for use by them.

"So far as this city has gone in adopting the practice of purchasing materials for use in contracts, I believe, that the results have fully warranted and justified the adoption of the prac-

tice. As to whether or not it would be advantageous to go further is questionable. Some corporations, particularly railroad companies, go a great deal further as, for instance, furnishing all Portland cement to contractors.

"In order to avoid excessively high contract prices for contingent items for certain materials we fix the prices in the proposals for certain materials, as for instance, extra bags of cement and sheeting and bracing left in place."

Rochester, New York.—"The practice was tried and found successful (cement only) on one sewage disposal plant job."

Seattle, Washington.—"We have a tentative agreement with the cement companies whereby the contractors may purchase cement through the City at a price somewhat below the sum for which it may be purchased in the open market, but about all this amounts to is that the City guarantees prompt payment to the cement companies, as no attempt is made to store the material."

Wichita, Kansas.—"About 1919 this City handled a million dollars worth of miscellaneous pavement and sewers awarding contracts on the condition that the City purchase and finance the necessary materials for the work. We did buy under this contract two thousand tons of asphalt in advance of an increase in price and obtained delivery very promptly as material was needed. The last of it was used after the price had increased 100 per cent. On the face of it, this looked like a considerable saving to the City, but the contractor could have accomplished the same end. Our difficulty chiefly consisted in a number of attacks through the courts, grand jury, and otherwise, of alleged illegitimate contracts and alleged official profiteering and grafting through those large purchases in collusion with the contractors. Our energies and efforts were consumed for more than a month defending ourselves against these attacks with a possible saving to the City of not to exceed one per cent of the cost of the improvement. This saving consisted essentially in the difference of the interest which the City had to pay and that which the contractor would have had to pay."

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25 Cities Plan Airports.—Twenty-five more cities announced in September their intention of establishing municipal airports, according to the Department of Commerce. The list is as follows: Jasper and Sheffield, Ala.; Beaumont and San Diego, Cal.; Fort Collins and Telluride, Col.; Belvidere and Evanston, Ill.; Anderson and Indianapolis, Ind.; Washington, Iowa; Winnfield, La.; Grand Rapids, Mich.; Hannibal, Mo.; Crete, Neb.; New Rockford, N. D.; Columbus, Ohio; Huntington, Pa.; Martin, Tenn.; Menard and Palestine, Texas; Rutland, Vt.; Abingdon and Brookneal, Va., and Charleston, W. Va.

Chlorine and Sewage Odors

Editorial in October Sewage Works Journal

Evidence is accumulating to indicate that the use of chlorine is quite helpful for elimination of odors from sewage and sewage treatment works. This issue contains papers which describe successful use of chlorine for odor control in Texas, California, and Bath, England. Similar results have been reported from New Jersey, Kansas, Ohio, and Schenectady, New York. For several years chlorine has been used at Leipsic, Germany, for control of odors from sewage at the treatment works and from the Luppe and Elster Rivers below the city.

This simple means for control of odors will be of great value for many sewage treatment works now suffering from the plague of odors. Nothing condemns sewage treatment works so quickly for the average citizen as putrefactive odors, even though localized, and not intense enough to be classed as a public nuisance. The courts have frequently recognized the liability of cities for damages to adjoining property by odors from sewage works. A recent decision against the city of Marceline, Missouri, is quoted in U. S. Public Health Reports, 43, 2115, for August tenth, 1928.

Sluggish flow of strong sewage, high in sulphates, through large combined sewers practically always results in hydrogen sulphide formation, accompanied by obnoxious odors, and in some cases, by sewer disintegration by the oxidation of hydrogen sulphide to sulphuric acid. Chlorine applied at the source of such sewers will, in many cases, retard decomposition sufficiently to prevent odors. An interesting investigation of the chlorination of sewage to prevent sewer corrosion is now under way at the Orange County Outfall Sewer, Santa Ana, California.

Apparently the only problems in this development are those of cost, and the effect of partial sterilization on processes of sewage treatment. If, in all cases, it were necessary to apply chlorine until residual chlorine is present the procedure would be prohibitively expensive. Fortunately experience indicates that partial saturation with chlorine may be sufficient, in most instances, to prevent odors, and yet not harmful to biological processes of sewage treatment.

Not long ago we received a letter from a French chemist stationed at a packing-house in Australia. He wrote "I am told that the Chicago population prefers the smell of abattoirs to the salubrious emanation of chlorine." Apparently he had proposed chlorination for the Australian packing-house wastes, which proposal, he said, led his opponents to "some diabolical statements."

This is the most ardent advocacy of the use of chlorine that has come to our attention.

Pacific Northwest Water Works Men to Meet in November

The Fall meeting of the Pacific Northwest Section, American Water Works Association, will be held Nov. 16th and 17th at the Gowman Hotel, Seattle, Wash. The program papers will be presented at the meeting on the 16th. The morning session will start at 10:00 a. m. and the afternoon session at 2:00 p. m. The following papers will be presented at the convention:

"Water Resources of the State of Washington," by R. K. Tiffany, state supervisor of hydraulics, Olympia, Washington.

"Chlorination of Water Supplies in the Pacific Northwest," by H. W. Nightengale, sanitary engineer, Washington State Department of Health, Seattle, Washington.

"Should the Water Superintendent Favor Consulting Service?" by R. E. Koon, Stephens & Koon, consulting engineers, Spalding Building, Portland, Oregon.

"Underground Water Resources in the Vicinity of Tacoma," by Homer O. Blair, consulting engineer, Equitable Building, Tacoma, Washington.

"Legal Phases of Financing Municipal Water Sytems in the State of Washington," by Bruce C. Shorts, Shorts & Denny, attorneys, Alaska Building, Seattle, Washington.

"Design and Construction of a Three Million Gallon Covered Concrete Reservoir," by C. A. McClain, general superintendent, Eugene Water Board, Eugene, Oregon.

"Relation of Fire Service Protection to Growing Concentration of Property Values," by H. H. Boten, chief engineer, Washington Serveying and Rating Bureau, Seattle, Washington.

On Saturday, Nov. 17, through the courtesy of the City of Seattle, extended by W. B. Severyns, superintendent, Water Department, all those in attendance at the meeting desiring to do so, will be taken on a trip over the distribution and supply system, including some of the reservoirs in town, the shop and stores buildings, and the intake and supply works.

Kenneth Shibley, 1005 Securities Bldg., Seattle, Wash., is secretary.

$11,000,000 Street Widening Program at Portland, Ore.—According to a report of O. Laurgaard, city engineer of Portland, Ore., a total of $11,476,300 is involved in the costs of the proposed program of street widenings and extensions which the city council will consider as to placing before the voters for their approval at the November election. Of this grand total, it is proposed that $6,209,920 shall be provided by a city bond issue. The remainder would have to be paid by assessment districts.

Map of the United States, Showing Snowfall, Using Contour Lines to Express Depth in Inches; From U. S. Weather Bureau and U. S. Bureau of Public Roads Records

City Snow Removal Campaigns Throughout the Snow Belt

What the Municipalities Did Last Year, Equipment Available, and Plans for the Coming Winter

THE WINTER of 1928-29 is close at hand. The many cities and towns throughout the snow belt are repairing and repainting old equipment and are obtaining additional new plows, loaders, trucks, and other snow removal equipment within their means to meet the requirements of the impending storms. Labor is being recruited where needed, or plans are being made for obtaining the necessary men on short notice when men will be needed. Appropriations are made or are being made, and organizations are being overhauled in order that emergencies may be quickly met as they arise. It is indeed timely, then, to review the experiences of various communities during the past year, tell what equipment is now available in those communities, dwell a bit on the costs of snow removal work and the budgets ordinarily provided to defray the costs, and to consider the plans that have been made by these communities for the coming season. From this data, presented as a result of enquiries sent to authorities throughout the snow belt, other communities, who perhaps have not yet perfected their plans for the season, may see what is done elsewhere and be guided in their plans by the experience of others.

An Important Matter.—It is of prime importance to every property owner, wage earner, school pupil, business man, and merchant in any community that the snow be removed as fast as it falls. A blizzard of even ordinary proportions will so choke the streets of a city in the snow belt that traffic will be quickly brought to a standstill, business cannot reach the doors of the offices and stores, property will be without the ordinary fire and police protection, foodstuffs will be delivered only under the greatest of difficulties, medical aid will not readily reach those in need, and the children will be unable to pass between their homes and the schools. The net result of this blockade may mean a stoppage of business, with important direct financial loss to business men, it may mean the destruction of property by fire, it may mean the loss of lives, and it may mean the undesirable interruption of the schooling of the children of the community. The losses thus incurred are usually directly measurable in dollars and cents, and the total, while it will depend upon the size of the community and the general state of business, will be many times the cost of preventative measures. Snow removal costs money, but the snow removal dollar repays many dollars into the pockets of the taxpayers.

Where It Snows.—The map shown herewith will indicate the normal snowfall in the various states of the Union. As may be observed, the snow belt includes some 36 states, containing a great proportion of the population of the country, and many of our largest cities. While the snowfall in these states varies somewhat with the year, and while local conditions will minimize the snow trouble in some communities while other nearby communities are profoundly affected, in general the map indicates the general condition that is to be expected year after year.

Methods Used.—While there are many small communities where the only activity carried on is the plowing of some sidewalks, where the property owners are expected to keep their own walks clean, and where the main thoroughfares are state highways and kept plowed by state forces, the larger community generally finds it necessary to use some plowing, loading, and hauling equipment, and considers it advisable to distribute as many snow removal jobs to the unemployed as possible. A few communities rely entirely upon this hand labor and various hauling equipment, while others utilize well organized patrols, equipped with the latest equipment, pile the snow along the curbs, load this snow by mechanical means, and then haul it to the dumps with the aid of city-owned and rented hauling equipment. Some cities not only utilize this modern equipment, but hire a lot of temporary hands for snow removal work as well. Other communi-

Using Snow Loader (Barber-Greene) to Load Piled Snow Into Motor Trucks

Using a Truck Crane (Universal) to Load Piled Snow Into Trucks

A Russell No. 4 Patrol Blading Snow to Curbs in Peoria, Ill.

ties, fortunately situated, are able to plow the snow to the curb, and in a day or two it will have melted and been carried off by the storm sewers, the gutters being kept open for the purpose. One city, partly surrounded by water and having many streets sloping down to the water front, is able to flush the snow down these streets and into the water by means of fire hose, where the temperature is high enough so that ice will not form during the process. In short, there are various means of handling the snow situation, where it is handled at all, and these means are governed by geographical, topographical, meteorological, and financial considerations, as well as by considerations of labor supply and custom. It is this widely assorted collection of methods and systems, together with conditions and equipment, that make the subject of snow removal one of perennial and absorbing interest, even if one disregards the compelling great importance of the matter to the community. The following statements will show just how snow removal is handled in various cities, what equipment and labor is used, and how much money is spent on these activities.

City of Yonkers, N. Y.—As far as actual snow fighting equipment used by the City of Yonkers, N. Y., is concerned, at the present time, there is available, according to John F. Torpey, Commissioner of Public Works:

1 Nelson snow loader.
3 10-ton Holt Caterpillar tractors.
5 5-ton Holt Caterpillar tractors.
5 Baker snow boxes.
9 Push plows.
3 Tractor "V" type plows.

When 3 in. of snow has fallen the watchman at the city garage gets in communication with the superintendent of the garage, who in turn calls out the emergency crew, which consists of mechanics, chauffeurs and helpers. It usually takes about one hour after the watchman has notified the superintendent of the garage to place all tractors, snow plows and equipment on the road.

In the event of a very severe storm, the men work in eight-hour shifts until relief has been given every traffic lane in the city.

Besides the equipment noted above, it becomes necessary for the city to hire trucks, laborers, plows, tractors, etc. The latter equipment (plows and tractors) that are hired are usually sent out into the outlying sections of the sections and are so employed until the snow ceases to fall.

The men that are placed in charge of snow removal gangs are those that are regularly employed as foremen, assistant foremen and men who have been with the department for a long period, and are acquainted with the practices employed by the Department of Public Works in snow removal. Of course, besides the hired equipment, the city presses into service every piece of equipment it has available, i. e., that used for the removal of ashes and garbage; street cleaning and other road improvement equipment.

During heavy sleet weather, when it becomes difficult for pedestrians and automobile traffic to move along at its regular pace, emergency crews are assembled and sand is placed on all the main arteries, especially the hilly sections of the city.

During the winter season of 1927-1928 the sum of $63,590.60 was expended by the City of Yonkers for the removal of snow.

City of Lansing, Mich.—According to A. Winegar, Supt. of Public Works, City of Lansing, Mich., their equipment consists of thirty-one No. 6 Eureka horse-drawn plows for sidewalks, and one Barber-Greene snow loader for removing the heavy snow in the streets, and several trucks for hauling away the snow collected.

As to the costs: The approximate cost of snow-plow work from Nov. 14, 1927, to May 7, 1928, was $2,712.46, and for snow removal was $3,030.65. These figures do not include up-keep of the equipment.

There are so few teams now, and the work so uncertain (depending entirely on the weather) that the superintendent has great difficulty in finding reliable drivers for the plows. After a sudden heavy fall of snow it is impossible to cover all streets at once, but the people do not realize this, and he has many complaints, according to his statement.

City of Kenosha, Wis.—According to P. J. Hurtgen, Director of Public Service, the City of Kenosha, Wis., has a land area of 4,576 acres, a population of 58,250, and has 141 miles of streets, of which 80 miles are paved with a permanent type of pavement.

No attempt is made to remove snow from the streets except in the commercial districts and the principal street intersections of the city. The city has three distinct commercial districts, known as the Down Town, North Side and West Side areas, and from these districts the snow is removed entirely, or to such an extent as to cause a minimum of inconvenience to the traveling public. Previous to last win-

The Same Outfit Has Worked the Snow to the Curb

ter all snow that was hauled away by trucks was loaded by hand.

The practice is to plow and scrape snow in windrows on each side of the street to the gutters and from that point load it on trucks either by hand or machinery, or both, depending on the amount of snow necessary to be removed.

The windrowing is done with ordinary blade plows mounted on the front end of 2½-ton trucks and one blade plow mounted on a 4-ton crawler type tractor. The city also operates two Wehr type graders mounted on Fordson tractors, with the blade attached between rear and front wheels of tractor. The latter units work successfully in snow not exceeding one foot in depth. After the snow is windrowed in the above manner, it is ready for hauling to the dump or sewer.

There has recently been developed a blade snow plow, known as the Gettelman plow, that works very efficiently in that the snow rolls and slides along the blade and requires considerably less power to operate than most snow plows now on the market, he states. This plow is so shaped that it acts on the same principle as does the mold board on an ordinary field plow by turning and rolling the snow rather than pushing it as some of the snow plows do.

Last year the city purchased a Lessmann Loader with a ¼-yd. bucket for loading earth and a ½-yd. bucket for snow loading. The bucket is mounted on a Fordson tractor with crawler tracks. This unit was purchased having in mind using it for snow loading in winter and loading earth, filling trenches, and leveling earth and rubbish on the dumps in summer. This unit works very well and economically, he states, in handling earth, filling trenches, etc., but is rather slow for snow removal. Not having had much snow last winter, it filled their needs very satisfactorily, but Director Hurtgen would prefer larger capacity units for snow removal where a large quantity of snow is to be removed. This unit, however, should be very satisfactory for the smaller cities which cannot afford large expensive snow removal units, he states. For large cities, the conveyor type of snow loader, he feels certain, would be most economical.

"V" Type Plows on Caterpillar 30 Tractors are Often Used

After heavy snow falls and on short hauls, the city has used horse-drawn ¾-yd. wheel scrapers and dumped the snow into the sewers where sewers were large enough to carry off the snow. The dumping was done through manholes at street intersections and in the middle of the blocks.

The snow hauling equipment used in Kenosha consists of 1½ to 3-yd. trucks, and in case of severe storms, the city also uses 3½-yd. garbage trailers. Hauls are usually less than 5 blocks. In the down-town section the snow is dumped into Lake Michigan. In the north side section it is dumped into the river, and the snow from the west side is hauled to vacant lots.

While no snow is hauled away in residence sections, the city does, however, when necessary, plow these streets by working the snow to the sides of the streets. For this work the city operates 8 V-shaped wooden plows, drawn by one horse, for removing snow from sidewalks, also one broom sweeper for sidewalk work. These are operated principally to clear sidewalks leading to the schools for the accommodation of the school children. The property owners, as a rule, take care of their walks. However, should the property owner fail to remove the snow from the walks in front of his premises, the Wisconsin law authorizes the city to remove it and charge it against the property and enter the charge on the tax bill. The rotary broom mounted on a Fordson tractor is used to clear the snow from the park walks and in front of city property, and works very successfully in snow up to 8 in. in depth. Along the street railway lines the utility uses a blade plow attached to the front end of a utility car and pushes the snow in windrows to the sides and, where deemed necessary, the snow is removed by both the city and street railway corporation.

From observations he has made Director Hurtgen is convinced that the best method of snow removal for large cities in the snow area is to employ plows to work the snow to the sides of the streets, and then with one of the belt, or chain conveyor type machines, convey the snow into 4 to 6-ton trucks and dispose of the snow to the nearest dump. That dump may be a river, lake, sewer, or vacant lot. The type of equipment necessary to pull or push the plows will vary with the depth and compactness of the snow. Up to 15 in., 2 to 4-ton tractors or trucks will handle the situation. For greater depths, up to 2 or more feet, 10-ton tractors may be advisable. For small cities some mechanical type of loader, such as he employed last year, will operate quite satisfactorily, using such capacity trucks as are available in the city departments. Steam shovels may be employed where wet snow has be-

A Good Combination Shown Here is the Caterpillar 30 Pulling a Blade Grader, Such as the Russell No. 1

A Light Tractor (2-Ton) and Grader Used on Park Work

come solidified by freezing, but from observations, he is convinced that because of their unwieldiness they should not be purchased for snow removal work. However, if a city is fortunate enough to have a steam shovel for excavation work, it might be profitably used for snow removal in lieu of hand shoveling.

City of Erie, Pa.—According to Theodore Eichhorn, Superintendent, Department of Streets and Public Improvements, snow removal activities in Erie, Pa., have been confined entirely to hand labor. The only equipment for taking care of snow conditions is a tractor equipped with V-shaped snow plow.

There has been some agitation for the purchase of a snow loader and other necessary equipment and no doubt within the next year the city council will provide funds for the purchase of machinery to take care of snow conditions.

City of Minneapolis, Minn.—According to W. J. Walsh, Assistant Engineer, Engineers' Department, the City of Minneapolis has 130 plows for cleaning sidewalks and gives each team about 12 to 18 miles of walk to plow. For the streets the city has Baker blades to attach to trucks, also Wasau and LaPlant Choate plows, to be used on tractors.

In the loop district the city stock piles or blades out from curb and hauls to dump with teams and sleds with boxes that hold from 8 to 10 cu. yd. of snow. The cost of this work is about 19 cents per cu. yd.

Their experience shows that it is best to start with the storm or after it has been snowing for a while and looks as if it may continue. They are also governed by weather bureau reports.

The blade plows are 10 to 12 ft. wide, so that the traffic is given a two-track road on all main travelled streets during the storm and after the storm has stopped.

City of East Cleveland, O.—The City of East Cleveland's snow removal equipment, according to Chas. F. Carran, City Manager, consists of 2-blade plows on 2½-ton dump trucks, 1 tractor blade plow, 1 tractor broom, 1 tractor sidewalk plow and 15 horse-drawn sidewalk plows.

A considerable part of the work is done on the four hills in East Cleveland, where in addition to snow removal waste salt is used to keep the pavement bare of ice and snow. A salt spreader drawn behind a small truck is used for this purpose. Salt is also used extensively in cleaning raised safety platforms on the main thoroughfares.

It has not been the practice in the past to remove snow by hauling it to the dumps. It is plowed onto the tree-lawns and away from street intersections. A small amount of hand work is done opposite business places, if the amount of snow piled up warrants it. It has been found of great advantage not to wait until the snow storm is over to commence work. Work is started when the storm sets in, and in this way the forces keep ahead of the snow.

City of Beloit, Wis.—According to G. E. Heebink, City Engineer, Beloit, Wis., this city, with a population of 25,000, with 36 miles of gravel and dirt streets and 50 miles of paved streets, keeps all streets open for traffic. Work is started as soon as depth of snow reaches 4 in. and is kept up until all streets are cleared.

Equipment:

- 4 Blade plows on 5-ton trucks.
- 1 Blade plow on Fordson caterpillar tractor.
- 1 Galion grader with Fordson caterpillar tractor.
- 1 Russell grader with Fordson tractor, rubber tires.
- 1 Sargent snow scoop with Fordson tractor.
- 8 Snow scoops, for moving snow with teams.

Blade plows are used to push snow on grass plots between curb and sidewalk on residential streets and into windrows in gutters on business streets. Snow in business districts is carried by scoops and dumped into snow holes in floors of bridges and in storm sewer manholes. The 1928-29 budget for snow removal roadways is $3,500.

City of Camden, N. J.—Frank E. Hanna, Director, Department of Streets and Public Improvements, City of Camden, N. J., states that his snow removal equipment consists of 2 snow loaders and 7 plows, which are attached to city trucks.

Their climate is such that they are not bothered a great deal with snow. The cost of snow removal last year amounted to $11,627.95.

His idea in handling snow is to remove it from all business district streets with the snow loaders, using the plows through the residential sections.

Annapolis, Md.—According to Walter C. Munroe, Engineer, Annapolis Water Company, of Annapolis, Md., this city is practically surrounded by water and on streets leading to the water front snow is removed by flushing down grade with fire hose.

In the upper section of the town snow is loaded by hand into trucks and removed to nearby places of disposal. This locality has very few heavy snows and special equipment for its removal is not necessary at this time, since it is more economical to hire men and trucks than to own special equipment.

City of Baltimore, Md.—According to C. F. Goob, Chief Engineer, Department of Public Works, City of Baltimore, Md., in January 1925, the city purchased 50 Champion snow plows. These plows are attached to city-owned trucks.

Under the direction of the Chief Engineer, the construction bureaus are organized and assigned certain work and districts for either snow plowing or removal.

The Bureau of Street Cleaning uses its ash and garbage equipment and employs extra trucks if necessary for the removal of snow.

This bureau has the eastern half of the Central District for plowing and snow removal. They are assigned nine plows. This bureau continues snow removal after the assisting bureaus have withdrawn their forces, when the greater part of the city streets are open for traffic.

The Bureau of Highways, with 30 plows, is allotted all outlying districts. It also removes snow from bridges and the Municipal Harbor Belt R. R. and other specially designated places.

The Bureau of Mechanical Electrical Service, with 7 plows, is assigned the western half of the Central District and removes snow from certain important streets and intersections.

The Bureau of Water Supply, with an allotment of 3 plows, is assigned the northeastern end of the Central Dis-

trict. It also removes snow from several important streets.

The Bureau of Sewers, in addition to keeping all sewer inlets open is assigned the removal of snow from the main streets. This organization will be continued during the coming winter.

City of Flint, Mich.—A letter from Harry C. McClure, City Engineer, Flint, Mich., states that records indicate that during the winter of 1927-28 a total of $6,675.45 was expended in snow removal. There were fewer snow storms during last winter than in many previous years. However, the winter was remarkable in that following the one storm of Dec. 30 and 31, more snow was removed from city streets and hauled to dumps than in any two previous years combined. The budget for the 1928-29 season totaled $14,155.60. This was arbitrarily cut to approximately $10,000.

Snow removal requirements are dependent entirely upon the annual snow fall so that it is not possible to anticipate with any great degree of accuracy the amount of money needed. There is considerable work in a winter month, such as cleaning safety zones, steps, bridges, cross-walks, removing ice from subways, cleaning ice and snow from catch basins, etc., which must be taken care of. The budget is based on five average snow falls, and provides funds for the following equipment and labor:

Equipment:

- 38 Sidewalk plows, 6 days.
- 10 Trucks for removing snow, 15 days.
- 1 10-ton tractor and plow, 20 days.
- 1 5-ton tractor and plow, 20 days.
- 1 Box-body roadster, 95 days.
- 1 Box-body roadster, 65 days.

Maintenance and repairs on sidewalk and street plows:

- Labor—Regular full-time help, 3 flusher operators, 95 days.
- Foreman, 13 weeks.
- Extra help as required by snow falls, 38 shovels in downtown district, 15 days.
- Compensation Insurance.

Materials and Supplies:

- 5 dozen shovels, 20-ton calcium chloride.
- General administration, 3 per cent.

The amounts required for these various items were not given, for the reason stated above, namely, that the budget request was arbitrarily cut and the department will be obliged to make changes depending upon the number of storms to be taken care of.

City of Rutland, Vt.—According to R. H. Royce, City Engineer and Commissioner of Public Works, City of Rutland, Vt., snow removal costs in that city for the winter of 1927-28 were as follows:

Repairs of equipment	$ 117.27
Sanding and cutting ruts	346.56
Plowing sidewalks	140.00
Plowing streets	161.91
Snow removal, business district	897.70
Cleaning cross-walks	24.38
Cleaning gutters	127.23
	$1,815.05

The snow fall was comparatively light and but little plowing of streets was required. The system in street plowing is as follows:

The city uses a 5-ton tractor and "V"-shaped plow in the business district, and two trucks with blade plows in the residential sections. Each driver has his section mapped out for him and proceeds to work at once upon notification. The police department call out the drivers at night.

The sidewalks are plowed by 8 horse-drawn plows; each driver has his own territory and drives his own team, and receives 8 hours pay for each call. If he misses any of his territory he goes back on his own time and corrects the mistake. Sand is kept available for covering the hill streets when they become coated with ice.

Gutters are kept open so that thaws will aid in removing snow which if left would pack into ice and cause expensive and laborious removal. Snow removal in the business district is accomplished by hand loading into trucks and sleighs, the disposal being made through manholes into a trunk sewer near by. The same general plan will be used this year.

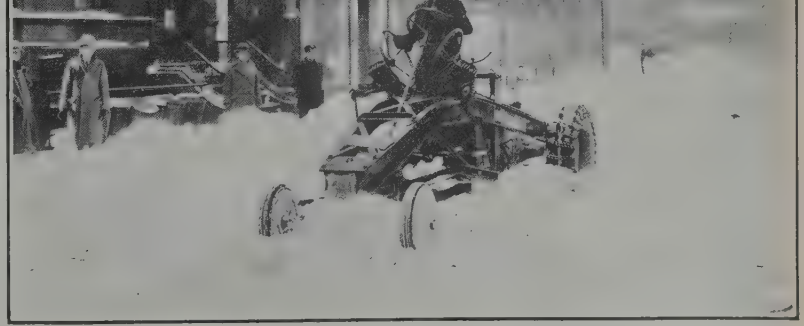
City of Wheeling, W. Va.—Herman L. Arbenz, City Engineer, City of Wheeling, W. Va. reports that last winter, 1927-28, they had practically no snow removal problems, but the winter before, 1926-27, they did have.

As a general thing they clean the main streets with "one-man" graders and bring the snow as near as possible to manholes wherever practicable; then shovel into the sewers by hand. Winter of 1926-27 the snow was, upon one occasion, too heavy to be disposed of in this manner and the city used a Barber-Greene elevator to follow up the graders and load into trucks and the snow was then hauled to the creek and river.

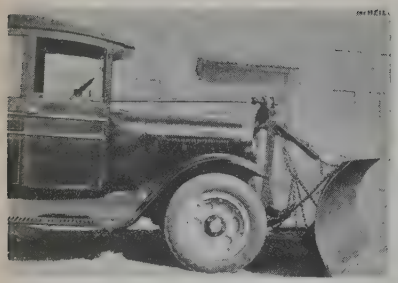
City of Cincinnati, O.—Fred Maag, Supt. of the Department of Waste Collection, City of Cincinnati, O., states that this department has three tractor snow plows, which are attached to Pierce-Arrow and Mack trucks. They are not contemplating buying any equipment the coming season. In recent years the snow fall in this city has been a negligible quantity. In the last five years the total amount of snow removed was 13,819 cu. yd., with an average labor cost of $0.759 per cu. yd. Before snow time arrives complete plans for removing snow are made. All supervisors have their instructions where they and their crew are to begin operations. The snow plows are started out as soon as the snow is deep enough. In the event of a very heavy snow, the entire personnel and all equipment, including emergency equipment, are centered on the removal of snow.

Quite a number of horse-drawn snow plows are available, and which are only used in case of a severe storm. There has been no occasion to use them in the last few years. All our efforts are concentrated in the business centers and arterial highways, and transfer and loading stations on the transportation lines. Every foreman has instructions to place his crew at the stategic points, so as to facilitate the speedy handling and prompt removal of the snow. Snow is hauled by trailer, wagons and trucks, and is dumped in such sewers that are large enough, and have a sufficient flow of water to carry it away.

City of Chicago, Ill.—Snow removal in Chicago is handled by four different jurisdictions. The Loop district and certain streets are under the jurisdiction of the Bureau of Streets, Board of Public Works, under the direction of Thos. H. Byrne, Superintendent of Streets. Work on certain parts of the South Side is done by the South Parks Commissioners, while work in certain West Side areas is under the jurisdic-



Using Patrol Equipment (Wehr Power Grader) on Municipal Work



Blade Type Plow (Such as the Gettleman) Mounted on a Motor Truck, a Popular Outfit

tion of the West Parks Commission, and on the North Side the work is done by the Lincoln Park Commissioners. Typical of methods used in these various districts are the methods used in the downtown section administered by Mr. Byrne, and essentially the equipment used is of the same type, except for a few motorized graders and crane outfits for loading that may be observed in the sections administered by the various park boards.

During the past winter, according to Supt. Byrne, his forces maintained a snow removal program on 31,341,680 sq. yd. of streets, mostly in the congested section, and in the calendar year of 1927 removed 299,963 cu. yd. of snow, or 48,189 loads, at a cost of $251,385.77. This gives a unit cost of 83.8 ct. per cu. yd., or about 8/10 ct. per sq. yd. of pavement maintained provides for an entire year of snow removal. This latter figure is rather low, since the city really requires larger snow removal appropriations than are available for the purpose if a more nearly ideal situation would be desired. While this expenditure normally minimizes blockades it cannot be said to permit 100 per cent snow removal immediately after and during a heavy storm, but it does permit keeping the streets fairly well open, except along the curbs.

Chicago Equipment.—The department maintains 4 Barber-Greene snow loaders, 5 Fox snow loaders, 25 Baker Model 2 trip blade plows with 8-ft. blades for mounting on motor trucks, 18 other blade plows of assorted makes, and 57 dump body trucks for plow use, together with a number of tractor trucks of the Mack Bulldog 5-ton "AC" model, and a fleet of trucks for use in hauling the snow. The plow truck fleet includes 36 Macks, 10 GMC trucks, 9 Supers, and 2 Service trucks. Other equipment is hired as needed. Some plows have been mounted on flushers, with the water tank filled with ballast. A heavy snow will require the services of as many as 800 trucks, many of which are hired for the emergency.

Policy.—The policy of the city is to get busy on the streets at the onset of the storm, first clearing the through streets and normal traffic lanes so as to keep the automobile traffic off the street car lines, and after cleaning up the Loop district so that business may proceed as usual in the morning, to extend the work of the outlying streets. The street car lines operate their own sweepers. Merchants and property owners clear their own sidewalks, pushing the snow into the street. The city forces, using the blade plows, pile the snow along the curbs, when it is then loaded by loader and hand into trucks and hauled to the river or other dump.

The equipment is kept in a garage and shops on the West Side, and in the fall equipment is put in readiness for action. Plow mountings are put on the trucks so that it will take but little time to mount the plows when the order comes in. On the edge of the Loop, headquarters are established for handling the labor. At any time after Sept. 1, any unemployed man may report at this place and receive a "snow card," bearing his name, serial number, and other information. Then, when a storm begins, he is able to report at this point and one presentation of his card is put on for the duration of the storm, issued tools and sent wherever needed. There is generally a great many more men available for this use than can be utilized, so the labor supply is no problem. The usual hangouts for such floaters and unemployed are to be found a few blocks to the west of this assembly point. At the end of the storm, when the work is done, these men then report back to the headquarters, turn in their tools, get this fact entered on their cards, collect their pay, and move along. These men are mostly used to load the trucks and perform other parts of the snow removal work that are done by untrained labor. It was stated that the average loading time of a truck is about 3 minutes. The plows work three shifts a day throughout the storm and until streets are all cleared, while the other forces work from 6:00 a. m. until midnight.

It is stated that the No Parking ordinance now in force in the Loop district has helped the snow removal work materially, since the snow can be piled along the curb unrestricted by parked cars, and since the loading forces can get at these piles of snow without being hindered by parked cars.

South Parks.—The South Parks Commissioners own about 36 Baker blade plows, four of which are operated on their own trucks, while the others are rented out to contractors, by whom most of the snow removal in this jurisdiction is done. The Commission also operates a snow loader in the downtown district. One or more 5 and 10-ton Caterpillars, equipped with bulldozers, are sometimes used to help out.

Snow removal contracts are let on the basis of bids covering availability for sudden call for day and night work at any time between Dec. 1 and March 1, and are governed by a complete set of specifications. Various types of equipment, including cranes and shovels, are used by the contractors or hired temporarily for work, as required.

West Chicago Parks.—The activities in the jurisdiction of the West Chicago Parks Commissioners are carried on in much the same way. Motor bus companies operating on their boulevards operate their own equipment, while the park has a few blade plows on motor trucks to pile up the snow along the curbs, and the snow is then loaded by hand into trucks and hauled to the dumps. The men needed for this work are recruited in much the same manner as is done downtown.

City of Sheridan, Wyo.—According to E. C. Gwillim, City Engineer, Sheridan, Wyo., his city is not greatly bothered with snow, and that most of the work is done with a grader powered with a Caterpillar 20 tractor, and that in some cases the roadway is broken by means of large trucks.

City of Cedar Rapids, Ia.—V. Janda, Street Commissioner, Cedar Rapids, states that their snow removal work is restricted to the loop district, and that tractor plows are used to build up windrows, and the snow is then loaded into trucks by hand and dumped into the river. When necessary, the forces work all night in order to keep the streets clear.

Leavenworth, Kans.—According to V. Thomas, City Engineer, this community uses manpower to shovel the snow and load it into trucks, and he states that flushers are sometimes used. Similar methods, except for the use of flushers, are reported from Moline, Ill.; Newport News, Va.; Boise City, Idaho; Casper, Wyo., and other communities.

Other Cities.—Fort Collins, Colo., has but light snows, and uses "V" type plows drawn by Caterpillar 30 and 60 tractors. In Cheyenne, Wyo., tractor-drawn blade graders are used to keep the gutters clear and to move the snow to the sides of the street, where it usually rapidly melts. The City of Dayton, O., does not make elaborate plans, but has a snow plow and some trucks available in case of need. Middletown, O., uses a road grader and scraper on its infrequent snows.

Standardization of Municipal Compensation.—The Salary Standard Board of San Francisco, Cal., has completed the first of a long series of steps toward the equitable standardization of municipal compensation, in the form of a classification of duties and responsibilities, for which the Board of Supervisors is vested with salary fixing powers. The purposal is now in the hands of the supervisors.

The Relation of Municipal Water Works Systems to Public Fire Protection

Comments on Some Problems Facing These Two Interrelated Services

By CLARENCE GOLDSMITH

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THERE is little diversity of opinion regarding the quantity of water which should be available from a distribution system for fire protection. The first full discussion of this subject was presented to the Association by Messrs. Metcalf, Kuichling and Hawley in 1911. In 1916 The National Board of Fire Underwriters published a formula in their "Standard Schedule for Grading Cities and Towns of the United States with Reference to Their Fire Defenses and Physical Conditions" based upon data secured in connection with their engineering investigations in over three hundred of the larger cities of the United States. This formula is now generally accepted as a standard for determining these requirements.

The burden of providing sufficient capacity in the supply works, supply lines, and arterial mains to deliver the required fire flow in larger cities having populations in excess of 200,000 is negligible. The principal problem is to provide distributing mains of sufficient capacity to enable the flow to be concentrated. The capacities available must be able to deliver the required fire flow when the prevailing domestic consumption is at the maximum daily rate.

Indianapolis' Facilities.—The City of Indianapolis furnishes a good example of a city having a population of between 200,000 and 400,000, having a water system capable of furnishing satisfactory domestic service. The average daily consumption is approximately 35,000,000 gal. and the maximum daily consumption is about 55,000,000 gal. The fire flow required is at the rate of 23,000,000 gal.; therefore, to satisfactorily meet the fire flow requirements, the system should be able to deliver these at the time of maximum daily domestic consumption, or at the rate of about 78,000,000 gal. As a matter of fact, the maximum hourly rates observed on the system during sprinkling hours in the summer are approximately 110,000,000 gal.; therefore, it will be seen that the combined maximum daily rates and the required fire flow are considerably less than the rate at which the system can deliver.

The Small City.—The fire flow requirements in the smaller cities, towns and villages, however, assume increasing relative importance as the populations lessen. For instance, a city having a population of about 20,000 has an average daily consumption of 2,000,000 gal., a maximum daily consumption of 3,000,000 gal., and a required fire flow at the rate of 6,500,000 gal., which gives a total required delivering capacity of 9,500,000 gal., while the maximum hourly demand does not exceed 4,000,000 gal. Even greater discrepancies will be found as populations decrease.

An Old Policy.—In the days of the steam fire engine it was more economic and considered more reliable to raise pressures on distribution systems in order to develop sufficient pressure to deliver fire streams. During this epoch steam-driven pumps were used most exclusively, there being only an occasional water power driven pumping station, and once in a while, an electrically-operated station, but the latter were rare. The raising of pressures on the smaller systems did not present any particular problem, because in such direct pumpage systems the prevailing rate of domestic consumption would generally be much less than the capacity of the pump in operation. This is not true, however, in the case of larger systems. For instance, assume a system in which the prevailing rate of domestic consumption is 10,000,000 gal. and that the pump operates under a domestic pressure of 50 lb. Upon receipt of an alarm of fire the pressure would be raised immediately to 100 lb. and the domestic consumption would rise immediately from 10,000,000 to about 15,000,000 gal., and this before the fire department was able to draw any water from the system. In other words, the pumping plant would be called upon to deliver one and one-half times as much water at twice the pressure, which means that the draft on the steam plant would be three times that under ordinary domestic consumption conditions.

Present Day Practice.—In order to be prepared to maintain fire pressure over any considerable length of time and supply any water for actual fire fighting, it would, therefore, be necessary to have sufficient boilers in operation to meet the demand on them, and running a steam boiler or boilers so much below their rated capacity is not economical. Today the gasoline engine driven motor pumper has reached such a degree of perfection that its reliability approaches that of the pumps in any pumping station, whether steam driven or electrically driven. It can be maintained and develop sufficient pressure for fire fighting at much less cost than pressures could be raised on the water system. In addition to this advantage, the danger of bursting pipes, rupturing plumbing, and blowing out connections at the very time when pressure is most needed is obviated. For the foregoing reasons the present accepted practice is to provide sufficient pumper capacity and not raise fire pressures.

The Pressure Needed.—A pressure of 75 lb. is generally considered necessary to develop small fire streams from hand hose lines, and it is desirable to be able to do this so that the first fire company responding can get into action before the fire has gained headway. Taking this into account, together with the prevailing heights of buildings, a pressure of from 60 to 75 lb. is now considered desirable domestic pressure to carry.

In the larger distribution systems where the pumps are located some distance from the high-value mercantile district, it is customary to maintain a pressure at the pumping station sufficient to maintain a certain predetermined pressure, say 65 lb., in the mercantile district at all times. This necessitates raising the pump pressure tion and permits it to be lowered during the night when consumption is at a minimum.

Poor Economy.—During the war, and immediately thereafter, some water superintendents endeavored to practice economy by lowering the pressure during the night below that required during the day and below the pressure needed to supply private fire protection equipments. In order that an automatic sprinkler system may function properly, it is necessary that the pressure be such that when 500 gal. of water a minute is being drawn through the system there will be a pressure of 12 lb. under the roof or on the upper line of sprinklers. In order that protection from private standpipe equipment may be effective, a pressure of 25 lb. on the highest hose outlet must be provided when 100 gal. of water a minute is flowing. Such equipments are generally only installed after tests have been made under normal domestic consumption conditions, and if pressures are dropped lower than this during the night, the protection to the property thus equipped is removed.

It is not uncommon to find buildings protected with automatic sprinklers located at points on the distribution system where increased consumption demands have brought about a reduction in pressure below that which was observed at the time of their installation, and in such cases this drop in pressure should be corrected by the installation of additional supporting mains in the vicinity, for any large drop in pressure is bound to result in an unsatisfactory supply for domestic use, particularly in the upper stories of buildings in the vicinity.

Pumping Capacity.—In direct pumpage systems the adequacy and the reliability of a supply are directly dependent on the number and capacity of the pumps in service. A sufficient number of units should be provided to permit the maximum daily rate, plus the required fire flow rate, to be delivered with two units out of service in order that complete reliability may be secured.

In order that this may be done, proper thought should be given to the capacity of the individual pumps, and this is particularly important when additional pumps are being installed in an existing station. A much less pumping capacity is needed where any considerable amount of elevated storage is provided. The question of the value of elevated storage has been brought to the forefront in the last few years by the erection of elevated steel tanks of large capacity. Such tanks on works supplying systems on which there is large consumption do not materially reduce the number and capacity of the pumps required. Such tanks, however, do make for economic operation and materially improve the quality of the domestic service when properly located.

Elevated Storage.—As a basis of computing desired elevated storage, it is customarily assumed that one or two pumps may be out of service for a period of five days during maximum consumption conditions, and sufficient storage should be provided so that ten hours' fire flow would be available during the last ten hours of the five-day period. In giving credit for elevated storage, consideration must be given to its availability, both in analyzing conditions in the existing works and in planning new works. Occasionally large elevated reservoirs have been constructed and connected to a distribution system by pipes of such size that their capacity could not be delivered into the distribution system at rates sufficiently large to utilize the water held in storage.

The quantities of water required for protection must be delivered throughout the distribution system so that they may be available about the group or groups of buildings which are to be protected and this necessitates the minor distributors of the distribution system's having a sufficient capacity to deliver the water required within a relatively small area without undue local friction loss.

Distribution Systems.—Although calculations of the carrying capacity of gridirons in extensive distribution systems can be made with a fair degree of accuracy, the best and most accurate results can be obtained by making flow tests. In the course of investigations made by engineers of The National Board of Fire Underwriters a considerable number of flow tests are made in each city inspected in order to determine the quantities of water available for fire protection in various sections of the city. These tests are used as a basis in recommending additional arterial feeders and the strengthening of the minor distributors where deficiencies are found. Water works engineers in general are making more use of this method of analyzing the carrying capacities of their distribution systems from year to year. Several years ago, our member, George H. Fenkell, made a complete survey of the distribution system of the City of Detroit by laying out tests including all hydrants on the distribution system. Four hydrants were opened at each test and the residual pressure was observed on a fifth hydrant. With this information at hand it was a comparatively easy matter to lay out reinforcing mains to provide an adequate supply for fire protection in all sections of the city. After the additional mains had been laid, as planned, the tests were repeated and the results showed that the desired increase in carrying capacity had been obtained.

Distribution of Hydrants.—The proper location and the installation of a sufficient number of hydrants are problems which should receive careful study, for, although a distribution system may have adequate carrying capacity to furnish the required fire flow, it frequently can not be utilized on account of the lack of hydrants or their improper location. Unfortunately, in the early days before the subject of hydrant distribution had been given sufficient study, their distribution was referred to as "hydrant spacing," and today it is frequently referred to in units of lineal spacing, whereas the area served is the only proper unit to use. For instance, the city blocks in the Portland, Ore., mercantile district are 200 ft. square. One hydrant at each street intersection, therefore, gives a satisfactory hydrant distribution of one hydrant to each 40,000 sq. ft., the lineal spacing in this case being 200 ft. In Salt Lake City, Utah, the blocks are approximately 700 ft. square, making the area of each block 562,500 sq. ft.; therefore, 14 hydrants per block are required to give a hydrant distribution of one hydrant for each 40,000 sq. ft. This would require the installation of hydrants in such a manner that the lineal spacing would be 87 ft.

Points of Difference.—The general subjects already touched upon are ones on which there is in general almost complete agreement among all parties concerned. Several subjects on which there is a diversity of opinion will now be touched upon in order that these questions may again be brought to your attention for further study and discussion.

In the major portion of the cities in the United States there is little question in regard to the size of the connection provided to serve private fire protection equipment. Occasionally, however, those responsible for the operation of the works oppose the installation of connections large enough to serve the equipment to be installed. This general subject has been under consideration by a standing committee of the National Fire Protection Association for the past twenty years, and the rules formulated by this committee are complied with by a large majority of engineers and superintendents. These read as follows:

"The conditions in isolated risks are so different from those in city buildings that it has been considered better to cover the two cases separately.

Isolated Risks.—"1. Permit 4-, 6-, and 8-in. service connections into yards, and in special cases larger ones where conditions warrant, and where more water is available and is needed for the best protection.

"Connections of the larger sizes are only permitted on the ground that every such connection has an easily accessible controlling valve as required by Section 2.

"2. Every service connection into the property to have an outside gate-valve located where it will be accessible in case of a fire in the property.

"Accessibility means that the valve must be so placed that it can be easily and surely gotten at and operated under any condition of fire which could occur in, or about, the protected plant.

"Generally in such properties there is ample yard room so that the valve can be placed well away from all important buildings and an indicator post provided.

"Where this is not feasible there is usually a solid tower, section of blank wall, or other protected section, against which the valve can be placed and safely shielded.

"In a few cases it may be necessary to build a fireproof valve room and provide access to it which would be safe under any conditions.

"The local conditions should be studied in each case of this kind and the arrangement best fitting the special surroundings adopted.

"3. Every connection over 2 in. in diameter from the yard mains into buildings to have an outside valve located where it would be accessible in case of a fire in the building.

"This applies mainly to connections for sprinklers or hose standpipes, but also would apply to any connections over 2 in. for manufacturing or other purposes. Valves on such connections cannot always be located as safely as those on the main service connections required by Section 2, but should as far as possible be located with the same ideas of accessibility.

"4. All such controlling valves larger than 2½ in. to have indicator posts, or, where posts are not feasible, to preferably be located in valve wells, the gates to be of the outside screw and yoke pattern, and the location of all such valves to be plainly marked by signs which will always be visible.

City Risks.—"1. Four-inch service connections to be used for smaller equipment, where this size of pipe will furnish ample water for the equipment.

"2. Six-inch connections to be permitted where the size of the equipment requires more water than a 4-in. can deliver.

"Where the sprinkler systems can be designed in two or more sections and the arrangement of buildings permit taking connections from different street mains, or from well separated points on the same main, it is better to provide two or more 4-in. connections, each supplying separate and independent sections of the system, where this can be done without unduly increasing the cost or decreasing the efficiency of the sprinkler system.

"This reduces the chance of one break caus-

ing a serious waste of public water, or an interruption of service to more than one section at a time. Where pressure is high and mains large, 4-in. services will often supply ample water, where pressure is low or mains small, larger services are necessary to bring enough water to give efficient sprinkler protection.

"Where in city risks the controlling valves required by Article 3 are favorably located so that they would be accessible and likely to be properly handled in case of fire, 6-in. connections could more freely be permitted.

"3. All such service connections to have outside controlling valves in one of the following ways:—

a. At the curb line with an indicator post.
b. At the building line with an indicator post set in a recess in the building wall.
c. In a valve pit near the middle of the street, or at the curb if a cover in the street is liable to be obstructed by snow or ice.
d. In bad cases, the connection may be looped back and the indicator post or valve pit set on the opposite curb across the street from the building protected; or the connection may, in some instances, be offset so as to come opposite an adjacent building rather than the one supplied.
e. Frequently the controlling valve can be pleaced opposite a stair tower or a division wall, where there is the least chance of falling walls making it inaccessible.
f. A hand wheel should be kept on each valve, and valves of the outside screw and yoke type should preferably be used.

"Street mains should be so gated that in case of necessity not more than a block length, or a maximum of 500 feet of main will be shut off.

"4. All valves on fire services to be plainly marked with the direction to turn to open, size of service, and what it controls.

"This marking can go on indicator posts where they are provided. Where the valves are in the ground, plain signs should be put on adjacent building walls, giving also the distance in feet to the valve. It is possible that some uniform sign in wording and color can be developed for any one city which would be recognized wherever seen. It may further be possible to have a standard adopted for use in all places, thus giving the quickest recognition to such valves.

"5. All manufacturing connections above 2-in. to be similarly provided with gates.

"6. In cities having a number of buildings protected by sprinklers a small squad of intelligent men should be organized to handle the valves in case of fire under the direction of the chief of the fire department.

"This squad could be formed either from the fire or water department, or possibly from both. With the growth of automatic sprinkler equipments it is necessary to have an efficient body of men who will understand the value of sprinklers and the best method of handling them to take charge of these matters at severe fires. The fullest use of private protection requires in cities that valves be cared for by men who especially understand the whole system and who will work in full conjunction with the public department."

Large Building Connections.—It is recognized that large connections into buildings from the street mains of a municipal water system may, in case of a large fire, prove a very great detriment, if they were broken off, and would put the system out of commission. In all conflagations on record, the wastage of water has been very large, but this condition would be true in a conflagation even though there were no excessively large openings. A study of fires extending over the past twenty years shows that the danger of bleeding water works systems by broken connections is almost entirely lacking when these services are used only to supply automatic sprinklers.

Whatever difference there may be on this subject appears to be due to the fact that it has been discussed in general and hypothetical terms rather than in specific terms. The engineers and inspectors connected with the fire insurance business are vitally interested in automatic sprinklers and their connections. For this reason it is believed all water works officials will acknowledge that this class of large service connections is the least troublesome of any.

Emergency Water Supply.—From year to year the American water consumer has been demanding a better quality of water for domestic use. Our well organized State Boards of Health safeguard the quality of the supply furnished by regular supervision, and anyone today touring across the continent can feel absolutely safe in drinking water direct from any municipal system. Many water plants maintain water in storage in large or small quantities immediately available for emergency use. Such water when under the direct supervision of the water works officials is maintained continually in portable condition.

During the last century such scrupulous care was not given to emergency supplies and many connections were made from such supplies when they were polluted. A water works man today takes an entirely different view of the matter, and these connections are rapidly being removed with the support of the several State Boards of Health. Many of these polluted supplies were made available solely for fire protection purposes and there is still a feeling among some few that such connections are now approved by the underwriters' engineers.

Position of National Board.—The National Board of Fire Underwriters is a voluntary organization of two hundred and twenty stock fire insurance companies. Their Chief Engineer, one of our members, Mr. George W. Booth, has from time to time gone on record on this subject, and it may not be amiss, so that there may be no further misapprehension, at this time to state his views, which are accepted and followed by the companies of the organization which he represents:

"The engineers of The National Board of Fire Underwriters do not, and we believe other engineers should not, favor such connections, but there are cases where they have already been made, and it is not possible, without the charge of discrimination, to refuse credit for them as emergency sources. It is, however, standard practice with many of the insurance bureaus to recommend secondary sources of supply which will be safe, as, for instance, a storage reservoir."

In connection with our city inspection work done by our own engineers and by engineers of the several rating bureaus, close relation is maintained with the State Boards of Health in many states, and our reports are placed in their hands so that they may have available any information which may be of interest to them. In the application of the Standard Grading Schedule to determine the class of fire protection, credit is given for polluted emergency supplies only when we are furnished with a signed statement from responsible city authorities that the supply will be utilized as soon as there is any shortage in the regular supply.

Charges for Protection.—The financial structures of few water works provide for the proper allocation of the cost of fire protection. One has only to review a tabulation of the hydrant rentals charging in different cities to be convinced that the revenue from this source has little, if any, relation to the actual cost of furnishing fire protection. Some of the more recent franchises granted private water companies do, however, provide in a fairly equitable manner for revenue from this source in proper proportion.

In these days of budgets, conservation, and efficiency, each municipally owned water system should be run on the same financial basis as it would be run if it were a private corporation. There is no valid reason why the water rates for domestic purposes should cover, in whole or in part, that portion of construction and operation expenses which are directly due to fire protection.

Five years ago Mr. Ernest C. Willard of Portland, Ore., made a very complete analysis of the cost of construction and operation of the water system supplying Portland. The system was divided into zones and after the fire protection requirements had been determined, the various charges were divided between the domestic and fire protection service. Similar divisions were made in the cost of construction and operation of the supply works and the general operating expenses. The final distribution showed on the basis of 77.9 per cent for domestic service and 21.1 per cent for fire protection. At this time the City of Portland had a population of about 300,000.

It is hoped that this matter will from now on receive the attention which it deserves so that eventually all of our water works systems will secure adequate compensation for the fire service rendered, and have it come from the proper source, which unquestionably would be from a general tax levy based on property valuation. When rates for public protection have been equitably established, the municipality or the private company will receive proper compensation for such hydrants, large pipes, pumps, storage reservoirs, elevated or ground, which are required in excess of those required to furnish domestic consumption. This protection will be paid by the individual property owner, and this having been done, the proper compensation is provided for the service given, and in case of fire in any building without private protection, its extinguishment will be undertaken by the fire department which takes water from the hydrants provided and paid for. Such conditions require the response of four engine companies and two ladder companies in our larger cities, and in case the fire involves a considerable portion of any large build-

ing, additional fire companies, frequently as many as twenty or thirty, are required to cope with the fire. There appears to be no equitable reason to make any charge for a service connection to supply private fire extinguishing equipment beyond a nominal charge to cover the actual cost of maintenance of the connection as the delivery of the water to the property has already been paid for by the taxes levied for the public protection.

Private Appliances.—In order to analyze all the benefits which accrue from the installation of private protection appliances, such as sprinkler equipments, a city block of the character ordinarily found in most of our cities will be considered. The buildings in the block consist of a moderate area, 10-story, fireproof building exposed by an excessive area, 5-story, joisted-brick building adjoined by a 4-story building of small area, of similar type of construction, which general types of buildings occupy the remaining area of the block. The excessive area, 5-story building exposes some of the latter type of buildings across a narrow alley. This excessive area building has paid its proportionate share for protection furnished both by the water and the fire departments. A fire in the building may call for a fire flow as great as 10,000 gal. a minute, and the response of twenty engine companies. The building is a conflagration breeder and the buildings exposed all have a charge for the exposure hazard included in their insurance rates, and if the conditions in the block as a whole offer a hazard distinctly greater than normal, this fact will be reflected in determining the classification of the protection of the city.

Hazard Reduced.—It is true that the benefits resulting from the installation of a sprinkler equipment in this excessive area building of inferior construction will result in a material reduction in rates to the owner or occupant who will have been put to a considerable expense to install this protection, but considerable benefit will be enjoyed by other property owners in general because of the added protection. The exposure charges to the other buildings in the block will be reduced or entirely removed. The hazard in the block will be reduced with the result that no consideration will be given in the application of the Standard Grading Schedule for the hazard which existed before the added protection was installed. The probability of requiring large quantities of water and heavy fire department response, both of which would materially reduce the protection of other property in the city in case of fire in the building under consideration, would be reduced to a minimum. All expenses of installing connections to the street main, including a meter, if required, should be borne by the parties installing the private equipment, but no further charges beyond a reasonable maintenance charge appear justified.

Adjusted Charges.—If the financial set-up of the system is such as to provide proper revenue for fire protection, additional so-called "readiness-to-serve" charges for private equipment, if put into effect, would result as follows: The owners of all property, if none has private protection, will pay for public protection a certain proportion of the taxes on their property which will be based on the assessed valuation, say 3 per cent. Then if a sufficient number of buildings are equipped with sprinkler equipments and standpipes, the proportion which unprotected properties will be required to pay will be reduced, say 2½ per cent of the taxes paid, while the privately protected properties will pay in addition to the 2½ per cent of their taxes which will cover the public protection, a sufficient amount for private protection to make this general reduction of one-half of one per cent possible. This will result in the sum paid for public protection, plus the special assessment for private protection, exceeding the amount paid before the private protection was installed, while the unprotected property will be enjoying a reduction in cost of protection at the expense of the owner who has installed equipment at his own expense. In plain equity, the owner of the unprotected risk is receiving an entirely unjustified benefit, for it is his property which still makes it necessary to maintain a powerful fire department, provide large quantities of water, and makes sweeping fires probable.

Acknowledgment.—From a paper presented by the author before the 14th annual meeting of the Missouri Valley Section of the American Water Works Association, at Kansas City, Mo., Oct. 3, 1928.

Sanitary Features of Small Public Well Supplies

From Sept. 15 Ohio Health News

Small public or semi-public supplies, such as the wells, cisterns and springs found along the highways, at school houses, in parks and at tourist camps, have been receiving considerable attention during the last three years in what is termed the "Seal of Safety" campaign. While it is known that the public water supplies of the municipalities throughout the state are generally of a safe and satisfactory quality, the safety of other sources of water supply which are available to regular and casual users is uncertain. Many of the semi-public water supplies, however, are safe and satisfactory, and it is for the purpose of designating those supplies to the general public that the Seal of Safety campaign was inaugurated and is being carried on. During this campaign, data were collected by state and district health officials covering several thousands of these supplies. The information assembled relates to location of water supplies with reference to sources of contamination, such as improper drainage, sewers, privies, leaching cesspools; type of the water supply, whether a dug, bored, drilled, or driven well or a cistern or spring; development of the supply with respect to the wall or casing and protection afforded at the top, and also the design of the pump and manner of its installation.

A study of the data shows very clearly that low first cost and convenience, not safety, have been the deciding factors in locating and developing most of these water supplies, and it is quite evident that many improvements are necessary to render many of them even reasonably safe. In some cases it has been found that improvements in development of the water supplies, consisting of constructing suitable concrete slabs and installing proper types of pumping equipment, or properly seating the walls or extending the well casing was all that was necessary to do, in order to protect existing supplies in a manner that would make them safe. In other instances it has been found that the only reasonable way to secure a safe supply was to abandon the existing supplies for the reason that they were poorly located with respect to existing sources of contamination which were of such extent or nature that it was impractical to eliminate them, and to properly develop a new supply in a more suitable location, one removed a safe distance from all of the sources of contamination.

Moving Sidewalks for Paris

According to press reports the Municipal Council of Paris has decided to construct a system of underground moving sidewalks.

The sidewalks have been the subject of study for several years and three styles have been approved by successive Municipal Councils. The one to be tried out first will consist of a sort of moving platform, or rather three moving platforms operating at varying speeds. Passengers will be able to step from one to another without the slightest danger—as soon as they become accustomed to the new system.

The present intention is to apply the system beneath the streets connecting the various railroad stations of the capital. During the day, and probably until midnight, only light baggage will be admissible, but it is pointed out that as the French train service, as far as Paris is concerned, really is nonexistent between midnight and 6 o'clock in the morning, it will be possible to utilize the moving sidewalks for the transport of baggage and even carry foodstuffs from the country to the central markets.

Maintenance of Sewage Collection Systems

Data from 39 Large Cities on Sewerage Maintenance

By W. T. KNOWLTON
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THE appropriations made by municipalities for the maintenance of their sewerage collection systems are frequently inadequate. As the city grows in size and population, constant demands are made on the funds provided by the general tax budget for the maintenance of streets, police and fire departments, and other public functions, with the result that the amounts needed for the maintenance of sewers may be overlooked. In those cities where the sewer system is of the combined type, the discharge of ground water or surface flows into the sewers during the rainy season is generally sufficient to keep the sewers clean. This condition, however, does not apply where the separate type of sewer systems is in use as the discharge of sewage from the buildings frequently requires the use of water for flushing the smaller pipes at the upper ends of the system.

Causes of Troubles in Sewers.—The manholes and portions of the sewer pipes adjacent thereto are apt to collect sand and dirt, which enters through the manhole covers. Further down the line where the sewer pipes increase in size, there are at times stoppages due to the entrance of matter other than sewage, as the public considers that the system should be a general place of disposal for all waste material of a liquid nature. In warm climates and sometimes in temperate zones the roots of trees may casue an obstruction to flow if permitted to enter and remain in the system. The discharge of industrial waste is also a cause of trouble for the proper maintenance of sewers. In districts where restaurants and hotels do not properly segregate the grease from the disposal of waste entering the sewers from the kitchen, there will probably be considerable grease entering the sewer pipes which tends to reduce their capacity. In those parts of the system where the discharge of waste water from the laundries and canneries of different types is permitted to enter the sewers, it has frequently been found that considerable attention msut be given to prevent deposits caused by such discharge.

Difficulties in Securing Funds.—Prior to the beginning of the fiscal year for municipalities when the budget for the coming year is being prepared, it is the usual practice of city engineers to submit an estimate of cost for the maintenance of the sewage collection system during the coming year. The amount thus granted therefor has too often been the only amount available for maintenance. Should contingencies arise after the appropriation has been made, it is difficult to obtain the necessary funds and in some cases the system suffers on account of the lack of appropriations. Being out of sight the sewers are generally out of mind, and especially where funds are requested for the services of those who should be employed to properly keep the system free from stoppages.

Constant Supervision Desirable.—Like any other machinery which must be constantly supervised and kept in good running order, the sewage collection system of the city should have a sufficient number of men employed to make inspections and remove obstructions which may block the flow in the pipe system and cause an overflow of sewage from the manhole tops. At intervals of time the inspection may show that the flow is overtaxing the capacity of the sewer in which event arrangements will be required to install larger or additional sewers. Unless the necessary labor and material required for the proper maintenance of collecting sewers is provided, the system may become a nuisance and menace to the health of the community.

In those cities where the length of the system consists of but a few miles of sewers, the amount of appropriation is comparatively small. It is probable that in some cases no allowance whatever is made. As, however, the system increases in length some appropriation should be provided. In the larger cities of this country where the length of the system involves many miles and where the system is of the separate type, the amount required for maintenance will increase in a manner somewhat proportional to the size of the city.

Maintenance Costs.—To determine the existing conditions throughout the United States, the writer has obtained from the officials in various cities replies to questionnaires concerning the amount of population served by the collecting system, the total and average sewage flows, also the length of the system and the annual amount provided for maintenance. From these data, the writer has compiled a record

Table of Statistics Showing Mileage of Sewers, Amounts of Flow Therein, and Annual Cost Provided Therefor in Various Cities Throughout the United States

City	Sewerage System	Population Served	Flow in M. G. Total	Flow in M. G. Avg.	Length of Sewers in Miles	Maintenance Costs Annual	Cost per Mile	Cost per M. G.	Cost per $100 Assessed Valuation
Oakland, Calif.	Combined	.....	.....	.....	575	$ 71,301	$124.00	.....	.028
San Diego, Calif.	Separate	150,000	.....	.....	300	41,889	139.63	.....	.020
Denver, Colo.	Separate	250,000	16,790	46	600	53,363	89.00	$ 3.18	.012
Bridegport, Conn.	Comb. & Sep.	160,000	5,475	15	165	15,000	90.00	2.73	.006
Hartford, Conn.	Combined	188,000	8,760	24	174	11,624	67.00	1.32	.003
New Haven, Conn.	Combined	180,000	7,300	20	164	29,000	176.83	3.90	.009
Montreal, Canada	Combined	800,000	5,475	15	640	76,133	119.00	13.90	.009
Quebec, Canada	Combined	131,000	.....	.....	.....	12,000	160.00	.....	.012
Washington, D. C.	Combined	470,000	31,390	86	908	115,483	127.00	3.67	.011
Chicago, Ill.	Combined	3,074,382	320,470	878	3,948	789,740	200.00	2.47	.042
Baltimore, Md.	Separate	744,000	21,900	60	860	500,000	581.00	22.80	.027
Portland, Me.	Comb. & Sep.	70,000	.....	.....	100	.....	420.00	.....	.....
Boston, Mass.	Combined	1,512,179	89,790	246	2,845	835,424	293.00	9.30	.043
Worcester, Mass.	Comb. & Sep.	.....	8,212	22	282	59,957	213.00	7.30	.018
Detroit, Mich.	Combined	1,400,000	85,775	235	450	435,150	967.00	5.07	.013
St. Paul, Minn.	Combined	295,000	.....	.....	730	38,000	71.00	.....	.....
Kansas City, Mo.	Comb. & Sep.	290,000	8,030	22	720	38,000	53.00	4.73	.008
Newark, N. J.	Comb. & Sep.	460,000	26,375	75	375	118,000	314.00	4.47	.014
Paterson, N. J.	Combined	150,000	11,680	32	180	30,000	167.00	2.56	.....
Buffalo, N. Y.	Combined	600,000	54,750	150	660	25,000	38.00	.45	.002
New York, N. Y.	Comb. & Sep.	5,000,000	.....	.....	2,800	.....	.....	.....	.....
Rochester, N. Y.	Comb. & Sep.	324,500	15,877	43.5	482	42,544	88.00	2.69	.....
Syracuse, N. Y.	Comb. & Sep.	200,000	6,935	19	275	18,426	67.00	2.65	.006
Akron, O.	Comb. & Sep.	230,000	8,395	23	403	31,240	85.00	4.07	.01
Cleveland, O.	Combined	1,000,000	.....	.....	1,018	150,000	147.00	.....	.007
Columbus, O.	Comb. & Sep.	295,000	10,950	30	522	15,547	30.00	1.41	.003
Toledo, O.	Combined	308,818	10,220	28	360	24,291	67.00	2.37	.....
Portland, Ore.	Combined	350,000	9,490	26	886	65,000	73.00	6.84	.019
Providence, R. I.	Comb. & Sep.	244,000	12,410	34	289	121,702	421.00	9.80	.02
Dallas, Tex.	Separate	250,000	4,562	12.5	Main 66	65,000	.....	14.24	.026
Houston, Tex.	Separate	200,000	4,015	11	304	66,931	.....	16.67	.....
San Antonio, Tex.	Separate	170,000	7,665	21	352	10,000	28.00	1.30	.005
Salt Lake, Utah	Separate	130,000	8,760	24	328	12,628	38.50	1.44	.007
Norfolk, Va.	Separate	160,000	.....	.....	180	90,880	360.00	.....	.052
Richmond, Va.	Combined	200,000	7,300	20	362	5,945	16.00	.81	.002
Milwaukee, Wis.	Combined	600,000	36,500	100	750	125,558	167.00	3.44	.015
Seattle, Wash.	Combined	300,000	18,250	50	691	94,000	134.00	5.15	.035
Los Angeles, Calif.	Separate	1,004,000	31,407	86	1,990	240,964	121.00	7.70	.013
Toronto, Canada	Combined	560,000	23,360	64	642	167,898	261.38	7.18	.019

of the cost of maintenance per mile and also the cost based on the amount of flow. In addition a record has also been compiled showing how the amounts provided for maintenance compares with the assessed valuation.

In order that this information may be available for reference and use by those elsewhere, the writer has included these data with this paper in an accompanying table. From a study of this table one can compare the amount provided for the yearly maintenance of collecting sewers in his city with the average condition throughout the United States.

It will be of interest to note that, taking the entire record which has been tabulated, the average cost per mile is about $182.00, the cost based upon the amount of flow averages $5.60 per million gallons, and the average cost based on the assessed valuation of property within the city is about 2 cents for each hundred dollars of valuation. It is possible that some corrections may be made in the figures given in the table. As, however, the average of the different results is fairly consistent with the conditions in many of the cities, it would appear that the determination of the average cost throughout the country can be used in comparing the records for many cities where the problem exists of knowing how much should be allowed for the annual budget.

Acknowledgment.—The above paper was presented Oct. 9 at 9th Annual Conference of the International Association of Sanitation Officials.

Rock Asphalt on 20 Per Cent Grade

Pavement Construction on Cotaco St., Russellville, Ala.

By JOHN T. SOUTHGATE
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Cotaco street in Russellville, Ala., derived its name from a tribe of Alabama Indians. It is a very picturesque street. It is situated in the best residential section of the city and is flanked on either side by beautiful shade trees and handsome residences. The street proper is 41 ft. wide from curb to curb and is 2,000 ft. in length. The grade of this street for a distance of 1,000 ft. is 20 per cent and the street is so situated that it drains a large area.

One would wonder how heavy road building machinery could climb this hill and operate successfully, there being such a high percentage of grade. This was accomplished and with no great difficulty and a wonderful piece of street work was the reward.

The weather conditions were bad while we were constructing the concrete base. We had one hard rain that washed 10 cu. yd. of the concrete base away before it had attained its initial set.

In the construction of the Kyrock top on the concrete base, the question arose between the engineer in charge and the writer as to where to start depositing the rock asphalt, whether to start at the highest point of the street or at the lowest point.

The engineer in charge was of the opinion that the writer should start at the low point and lay the surface up the hill. His idea was that the rock asphalt would not stay put; that in the process of grading and raking that it would naturally slide down hill and would assume a less thickness than the specifications called for after being rolled. I argued just the reverse, and the engineer acceeded to me.

My principal argument was the destruction that would be wrought by being caught in a hard rain that all the water would run under the top before it had been rolled, causing a long delay waiting for the moisture to evaporate so that it could be rolled.

The writer clearly demonstrated to the engineers that the rock asphalt can be laid down hill and that, upon completion and tested for thickness, that no point was less than was called for in the specifications. There was no crawling of the surface ahead of the roller.

The engineer in charge was F. B. Brown, and his assistants were O. H. Murray and Jas. W. Noland.

To Improve Acoustics of the Bear Pit

The following ordinance was adopted Oct. 8 by the city council of Cleveland, O.:

"Whereas, the acoustic properties of our bear pit are such that many wise and humorous remarks are now lost, now, therefore,

"Be it resolved, that the city manager be and he is hereby instructed to report to the council as to the probable cost and expense of improving the acoustics of the council chamber."

Constructing a Rock Asphalt Surface on a 20 Per Cent Grade on Cotaco St., Russellville, Ala.

Developments in Water Purification

Recent Changes in Established Practice

By WELLINGTON DONALDSON
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IN determining the significance of changes or innovations in water-works practice, there is much latitude for individual judgment. Changes may represent merely fugitive experiments on the one hand or on the other hand may be destined to find a permanent place in development of the art of water purification. The water-works field is a wide one; local conditions are quite diverse; modifications of processes considered highly advantageous in one locality are wholly inapplicable in another where the character of water or other local conditions are different. In this paper the author will attempt to indicate briefly his personal reaction towards those recent changes in established practice which seem to him to possess the greatest general interest.

Speaking generally the most notable recent advances have been concerned with processes or modification of processes rather than with new types of structures. Of the structural changes noted in a survey of the more recent purification plants, the most important are concerned with mechanically cleaned settling basins, mixing facilities and aeration.

Mechanical Clarifiers.—Originally developed as a metallurgical process, the mechanical clarifier has been finding increased favor in water-works practice. Its first point of entry into water-works practice was in connection with softening plants where the voluminous precipitate produced by lime and soda reactions indicated advantages through continuous removal of sludge, in contrast with usual practice of intermittently emptying and flushing the settling units. The mechanical clarifier, at first circular in plan with crescentic inlet and outlet troughs, has developed into a square plan having more efficient settling characteristics. The early installations were separate independent structures. The tendency now is to incorporate the clarifier in one end of a rectangular settling basin, the two structures being integral and with a continuous water surface.

The first mechanical clarifier installation of record in connection with municipal water-works was at Benton Harbor, Mich., put in service in 1923. At the present time the mechanical clarifier has been incorporated in the design of some 14 water softening plants, chief among which are Newark, O.; Piqua, O.; Springfield, Ill.; Miami, Fla.; and South Pittsburgh, Pa. The efficiency and economy of these devices in comparison with the older style settling basins are not yet fully established, but their popularity would indicate that mechanically cleaned basins of some type are likely to find a permanent place in connection with water softening.

The utility of the mechanical clarifier for removal of the sludge from softening reactions has more relently been extended into other water purification fields. At Lancaster, Pa., and Decatur, Ill., clarifiers are used to serve in place of ordinary coagulating basins. The latest adaptation is a preliminary sedimentation device for the very turbid waters of the middle west. The Missouri River, for instance, has an established peak of 15,000 ppm., or 62 tons of dry suspended solids per million gallons, while 5,000 to 8,000 is not an uncommon occurrence during the spring and summer months. The customary practice on the Missouri and other muddy western rivers has been to provide extensive preliminary sedimentation in simple rertangular basins. The large amount of sediment deposited in these basins has necessitated putting them out of service frequently for a cleaning, with considerable inconvenience to operation and cost for labor and flushing water. These facts have led to the idea of continuous removal of the deposited sediment in a more satisfactory manner than can be obtained by well sloped or underdrained bottoms. The result has been an incorporation of mechanical clarifiers in at least two of the important midwest plants. The Kansas City, Mo., plant which went into operation in June of this year has four 200-ft. diameter circular clarifiers as preliminary sedimentation units. The new Missouri River plant of the St. Louis water-works now under construction includes five 150-ft. square clarifiers for preliminary sedimentation ahead of the softening processes. Operating results are not yet available at Kansas City under normal conditions to give a comparison with plain rectangular basins as to efficiency of removing suspended solids and operating costs. Until these points are settled, it is fair to regard the matter as in an experimental state in so far as these two installations may have a bearing on influencing practice in handling excessively turbid waters. They at least constitute a notable modification over the customary plant layout.

Mixing Arrangements.—Another feature of the filter plant layout which has been undergoing extensive modification within recent years is the mixing arrangement for facilitating the chemical reactions connected with softening or coagulation. The lack of flexibility of the older baffled type of mixing chamber for varied conditions of flow is well recognized and has led in recent years to experimentation with other types of mixing devices, though as yet no standard design has been evolved. The Topeka softening plant has a loosely baffled chamber with mechanical stirrers. Many of the recent softening plants employ single circular mixing chambers and mechanical stirrers. The Sacramento, San Leandro and Beverley Hills plants employ multiple circular mixers with paddle stirrers, operated in tandem. Knoxville, Tenn., is another recent example. The plants at Providence, R. I., Watertown, N. Y., Albany, N. Y., and Danville, Va., have circular mixing tanks without mechanical stirring devices, the tangential bottom inlets and tangential top outlets being relied upon to produce stirring velocities. The Kansas City and St. Louis works have somewhat similar mixing devices, with the difference that the tangential inlet is at the top while the outlet is at the center of the cone-shaped bottom. The flow is thus downward in a vortex.

Aeration in Filtration Plants.—Prior to the general adoption of filtration, aeration was regarded as an effective weapon for combating odors and tastes in stored waters. Later the marked benefits derived from filtration somewhat obscured the advantages of aeration and many representative filter plants built a few years ago were provided with meager or no facilities for aeration. More recently, however, there has been a recrudescence of the aeration idea as water consumers have become more critical of the physical qualities of the supply. In several instances aeration of both raw and filtered water is practiced.

Aeration is now employed for other than the original purpose of overcoming tastes and odors due to plankton growths or the effects of stagnation in stored water. Certain classes of trade waste responsible for taste and odor respond favorably to aeration, though others do not. At West Palm Beach and a few other places, addition of the alum dose prior to passage of the raw water through spray nozzles has been found distinctly helpful in promoting coagulation of a soft colored water.

At both Richmond, Va., and Rahway, N. J., it has been found that spray nozzle aeration is quite effective after substantial prechlorination doses in reducing residual chlorine to within non-troublesome limits. Another use for aeration which has come to the front, is its ability to lower the carbon dioxide content, thereby decreasing aggressiveness of the water. This has led to the use of the so-called effluent aerators as exemplified by the plants at Albany, Providence, West Palm Beach and Poughkeepsie.

That the aeration feature, aside from its utility, can be made to serve an ornamental purpose is shown very well by the Kensico and Ashokan installations of the New York water supply, and those at Providence, West Palm Beach and the San Leandro plant of Oakland.

In general, where the need of aeration is plainly indicated, the tendency has been towards the use of fixed spray nozzles in preference to other devices which are not so completely effective. Mention deserves to be made, however, of the floating nozzles in the Sacramento and Beverly Hills installation. In the latter, the released hydrogen sulphide gas is captured and discharged through a tall stack to avoid complaints in a high-class residence district.

Changes in Design.—No important changes in filter design have come to the front recently. There still exists considerable diversity of opinion as to the merits of various styles of underdrain systems; none of them is perfect and most of them are satisfactory. Of the filter appurtenances such as gages, controllers, etc., new designs have appeared within the last year or so, but nothing particularly novel has developed, excepting the substitution of electrical instruments at Wausau, Wis., for the usual filter flow gage. It seems to be merely a question of healthy competition among the manufacturers.

It is worth noting here the revival of the old Hyatt idea of washing a filter bed by sections instead of as a whole. It will be remembered that some of the early New York Continental filters employed the "quadrant" wash for a single undivided bed, but the idea fell into disuse. It has been revived in a modified form in some of the recent plants for washing beds made up of separate bays; for instance, at Poughkeepsie and West Palm Beach where the four bed sections are washed independently, and at the San Leandro, Calif., plant where the filter is washed by halves, the purpose obviously is to reduce the size of wash piping required and the demand rate of wash water.

Coagulant Experiments.—Much experimentation is continually being carried on in various parts of the country to discover coagulants better suited than is ordinary filter alum to certain types of water and to decrease the cost of the preparatory treatment. These experiments have dealt mostly with some form of sodium aluminate under various trade names, usually supplementary with alum. Results reported in some places are distinctly favorable, but in others the trials have shown no advantage either as to efficiency or cost over the customary treatment.

The repertory of water treatment chemicals is continually increasing. From Elizabeth City, N. C., comes a report of the successful use of chlorinated copperas as a coagulant for a soft highly colored (550 ppm.) swamp water after comparison with alum and sodium aluminate as a primary coagulant. The treatment is carried out by simply feeding chlorine to the copperas solution delivered by a dry feed machine.

The chlorination of water has expanded considerably. In addition to the common practice of applying the chlorine in a single dose to the plant effluent, many plants are now making use of split treatment, or application at two points. The practice is not uncommon of treating both raw and filtered water where heavy bacterial loading exists. In this case, application to the raw water is usually referred to as "prechlorination." Hackensack, N. J., is a recent convert to this practice, about 0.5 ppm. being used as a primary dose to the inlet of coagulating basin and a second dose of 0.15 ppm. being given to the filter effluent. At Toledo, O., the filtered water is treated twice to secure satisfactory bacterial results. In Richmond, Va., split or double chlorination is practiced in order to keep down algal growths in a shallow exposed clear water basin of considerable area. At Kansas City, Kan., a second application of chlorine is used to control algal growths in a distributing reservoir.

Another important use for chlorine is the so-called super-chlorination process whereby an unusually large dose is applied for the purpose either of overcoming extraordinary pollution or the destruction of obnoxious substances such as phenols which the water supply may contain. This method involves a secondary application of sulphur dioxide or other anti-chlor for reducing the excess chlorine, which would otherwise cause taste. It should be pointed out that super-chlorination is directed primarily to the destruction of taste and odor producing substances, which are not removed by the familiar processes of coagulation and filtration. In somewhat the same category, but widely different in principle, are the Cleveland experiments for removing taste and odor by filtration through a special activated carbon. So far as the writer is aware super-chlorination first exploited in this country by Howard at Toronto is now used on a routine basis only at Rahway, N. J.

Softening Water.—The last few years have witnessed notable additions to the list of softened municipal supplies in this country. Advances in this art have been due, as C. P. Hoover has pointed out, to the recarbonation feature which not only obviates the grief from incrustation, but gives effective sterilization and enables more complete softening to be carried out than hitherto possible by the lime-soda process, and at a lesser cost. Simpler and more dependable methods of recarbonation have been developed. The pneumatic system of handling lime as used at Springfield, Ill., gives promise of modifying the older mechanical conveyor method.

As regards zeolite softening, there are now seven installations in service for municipal water supplies in this country. With the exception of the 4.0 mgd. plant of the Ohio Valley Water Co. at McKees Rocks, the installations are all quite small, ranging from 40,000 to 200,000 gallons per day capacity. However, the extreme hardness of the water handled by some of them is notable.

The 2.0 mgd. plant at Sewickly, Pa., now nearing completion is notable for being constructed along lines of ordinary rapid sand filters. In other words, reinforced concrete replaces the steel shell construction found in the other municipal installations.

Modified methods of washing and regenerating the zeolite filter have come to the front, but in these it is not easy to distinguish between merit and salesmanship. From the published results, however, it appears that the McKees Rocks plant has succeeded in reducing materially the all-important salt ratio. It is interesting to note that a few industrial zeolite installations are reported to be using sea water or oil well brine for regeneration.

As stated at the outset of this paper, the matters which have occupied the attention of water-works people lately, are not so much new design features as the modified use of purification facilities already available along the lines of coagulation, softening and chlorination. The indications are that treatment of water instead of being simplified is becoming more complex and more highly specialized. The standards for hygienic safety have for some years been fairly well met. Now there is beginning to come to the front more prominently than ever before the expectation that public water supplies will not only be free from danger to health but shall be agreeable in their physical properties and reasonably low in hardness or other chemical constituents which affect its use not only by domestic consumers but by industries as well. How else can we interpret the refinements now taken for maximum color reduction, for taste and odor control, and the growing demand for softer water?

Acknowledgment.—The foregoing is an abstract of a paper presented Sept. 19 at the 47th annual convention of the New England Water Works Association.

Motor Driven Centrifugal Pumps

Well Systems—Automatic Operation — Obtaining Low Rates

By R. L. BALDWIN
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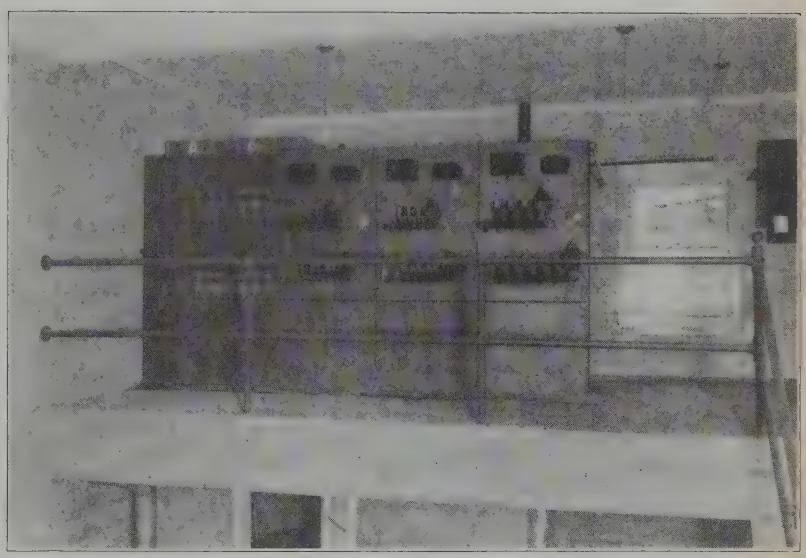
THERE has been great improvement and consequent increase in the use of the centrifugal pump since the first pump of this type was introduced over 100 years ago. The use of this type of pump has seen its great development since the introduction of the electric motor. It is this combination of equipment which the writer will consider.

Well Systems.—Many water supplies must use wells and the older systems have many deep laid suction lines with low service pumps placed in deep pits. Such installations are costly to build and maintain. Pipe sizes were necessarily very large, as friction losses had to be held to a minimum. When leaks developed the difficulties of location were generally so great that a vacuum pump was installed to remove the air as it collected. The draw down was limited to a suction lift of about 20 ft. less the friction loss in the pipe system. The history of most such installations is that the water plane gradually lowers as the use increases so that the installation has a constantly decreasing yield. The wells would be closely spaced, as their circle of influence would not be great due to the small draw down.

Late practice has used a smaller number of wells of a diameter 12 in. to 24 in. in which a centrifugal type of pump can be installed at the proper level to always be submerged. The motor driving the pump is generally direct connected and located in a small pump house built over the well. This type of well can be sealed from surface pollution much better than could the old type of well with individual manholes and drop pipes.

The discharge lines then can be laid at the usual depths for distribution pipe systems and the pipe is under pressure and can be easily maintained. The motors can be arranged for remote or automatic control and the operating labor kept at a minimum. A recent design consists of 7 wells, capacity 1,000 gal. each, spaced about 600 ft. apart. Well houses are without tower but each provided with a 2-ton hoist to handle pipe and equipment. Drop pipe and shafting was purchased in 10-ft. sections so that it could be installed or taken out in the headroom available. The discharge lines were brought together into a main which passed through a central control house where all water was metered and provision made for the application of chlorine. This house contained also the electrical control lines for all wells. Power was purchased at 4,000 volts and this voltage was used for the individual motor, thus avoiding a transformer substation and obtaining a very low power rate. The switchboard consisted of a receiving panel with one oil switch from which the power was taken by underground to each well house. Disconnects were provided at each house ahead of the automatic starting panel with local push button control as well as the push button control in the central control house. Each house was provided with a small transformer for lights and power to operate the solenoids. A four-wire control cable connects each well house with the central control house and each push button station is provided with red and green pilot lights so that the operator can know at a glance what wells are in operation.



Automatic Control for Three Motor-Driven Pumps at Independence, Mo.

The cost of pumping from wells by this means compares very favorably with that by any other system and if given a good load factor will pump water at a cheaper power cost than any other system and also has a very low maintenance cost. These pumps operate against 70 lb. pressure and with a 25 per cent load factor pump water at a cost of 4 ct. per 1,000 gal., which decreases to about 1.75 ct. per 1,000 gal. at full load.

This type of pump serves a good purpose as a low service pump where the water is taken from a river or other source having a wide variation in water level. The pump may be submerged while the motor is installed well above maximum high water and the whole unit suspended from the surface so that no foundations or working parts are located in the pit but can all be withdrawn by hoisting the pump to the surface when necessary.

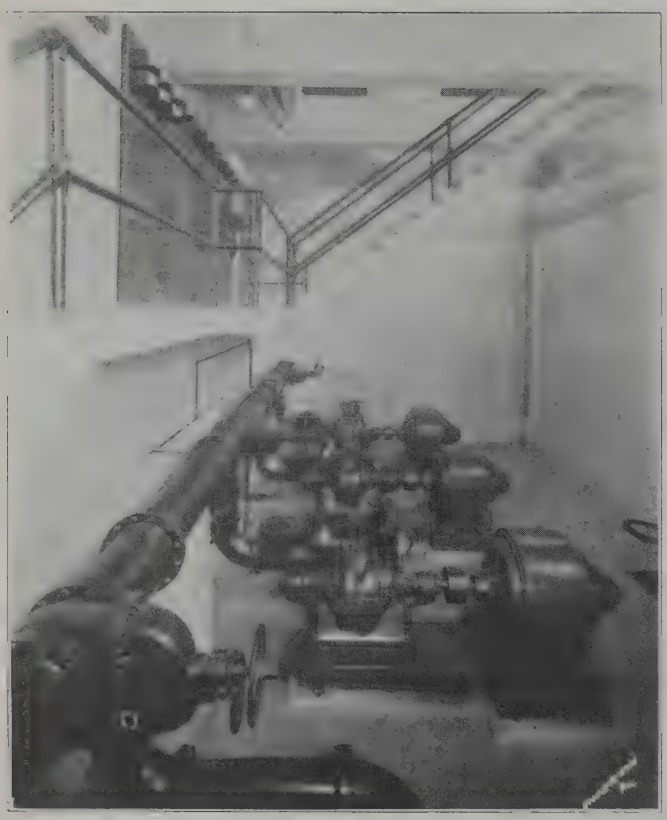
Automatic Operation.—In the use of motor drive it is possible to use automatic operation in many cases, making a great saving in the labor costs that are ordinarily required. For small districts, where boosters are required to serve them satisfactorily, a pressure type control can be used. Where possible, however, the control line should come from the tower and tank direct so that variations in pressure due to friction losses or use of water on the system will not cause the pump to start or stop. Such installations have been installed and operated on waterworks and sewer systems for a number of years and require only an inspection every day or two and give excellent service.

Where the distance from the tower and tank is great an electrical method of transmission of the start and stop impulses is desirable and very reliable devices have been perfected and are in use.

We have an automatic station serving a city where there are three pumps having capacities of 600, 1,200 and 1,800 g.p.m., respectively. These pumps each have automatic starting panels which

are controlled by a special panel on which is mounted a Ruggles-Klingemann regulator, a dial switch, a control circuit switch, a time switch and seven double pole control relay contactors.

When the water in the standpipe drops a definite amount the R.-K. regulator moves the dial switch to the first control point and contactor No. 1 picks up, closing the control circuit of the first starting panel, thus starting the motor of pump No. 1. If the water level continues to drop the R.-K. regulator moves the dial switch to second control point and contactor No. 2 closes the control circuit of the second starting panel, starting pump No. 2. Pump No. 1 stays in operation until pump No. 2 is on the line when the pump No. 1 is automatically shut down. In this way various combinations of pump are obtained to accommodate the pumping capacity to the load and hold an even pressure at the load center. Of course, there is variation in the friction head and care must be taken to get pipe sizes large enough that this will always be within reasonable limits.



Synchronous Motor Driven Pumps at Hannibal, Mo.

Slip Ring Motor-Driven Pumps at Trenton, Mo.

The time switch on the control panel mentioned above was arranged to limit the pump operation to one of the pumps during the power company's peak load period. Such operation and control depends entirely upon having elevated storage and is very desirable, giving very efficient operation as the pumps are operating very close to their rated condition under this scheme of operation.

There are automatic units, however, in use operating on different schemes and serving very good purposes. Where a well supply can be obtained at various points on the distribution system it is possible to supply the system at different points equalizing pressure and deferring the installation of large mains. Such pumps may be controlled by a pressure type controller and started only when the pressure drops below a certain point, and stopped when the pressure reaches a certain high point. Two such installations the writer has in mind are on systems having steam-operated main pumping stations. At certain periods of the year the demands are such that proper pressures can be maintained throughout the day, but at other periods there are times during the peak of each day's demand when these pumps automatically take the load in their district, thereby saving the cost of a large feeder line which would be necessary for only short periods of time.

Obtaining Low Rates.—It is important that the lowest rate possible be obtained for the power required for pumping. Often conditions are such that the pumping equipment may be designed to take advantage of low rate schedules. Most every power company has an off-peak rate and a discount for high power factor.

Where motors are 50 hp. and larger in size, serious consideration should be given the use of a synchronous motor which will give high power factor or may be designed to give a leading power factor if desired. Such motors cost little more in small sizes and may even be cheaper in the larger sizes than the ordinary induction or slip ring motor.

The starters may be automatic and an untrained operator can then be used and produce no line disturbances. A saving of from 5 per cent to 10 per cent in the power bill can generally be made in this way.

Where it is desired to obtain an off-peak rate some elevated storage is necessary. Many systems already have some elevated storage, but often it is not enough to accomplish the desired result, and so it becomes necessary to increase the storage facilities. The cost may be prohibitive if considered only for its saving in power cost, but there is generally another advantage in having such storage in that it equalizes the demands on the system in such a way that pipe sizes are smaller, or it may save laying a new feeder line, thereby more than paying for itself and at the same time making better service or giving the same service with lower station pressures.

These advantages of elevated storage are injected here because the motor-driven pump is peculiarly adapted to such a system and is at a disadvantage on a closed system, and it is often necessary when installing motor-driven stations to install elevated storage at the same time.

The power company wants your load and you want a low power rate. They may not know much about your business and you don't know much about theirs, so you are not in the best position to deal with each other until you interchange information. The power company's load, as a usual thing, reaches its maximum in the winter, while the water company's load peak is in the summer or fall. The power company is very anxious to fill up the valleys in their load curve and particularly to eliminate the seasonal peaks insofar as possible so that this should be your starting point and from this you can work out your storage problem to keep off of daily peaks and other minor details to get a minimum rate that will be mutually satisfactory.

Acknowledgment.—The foregoing is an abstract of a paper presented Oct. 1 at the 14th annual meeting of the Missouri Valley Section of the American Water Works Association.

World's Largest Sewage Treatment Plant Opened

The largest sewage treatment plant of its type in the world was officially opened last month by the Sanitary District of Chicago. The North Side plant, as it is called, covers 97 acres and was built to purify the sewage of an ultimate population of 1,340,000. It serves an area of 78 square miles, which includes eight suburbs as well as a large section of the city of Chicago.

The Chicago plant was built as part of a program to dispose of the city's wastes without injuring neighboring communities.

Formerly the Sanitary District treated all its sewage by diluting it with water from Lake Michigan and sending it through a canal 30 miles long to the Illinois River. This method was opposed by Great Lakes cities, which claimed that it was lowering lake levels, and by cities along the Illinois river because of pollution of the river water.

The controversy came to the attention of the Secretary of War, who permitted Chicago to continue this procedure on condition that it would begin installation of sewage treatment plants. The newly opened plant, supplemented by three already in operation, one being constructed and one being planned, will eliminate the necessity of drawing heavily on Lake Michigan for water and will bring to an end the heavy pollution of the Illinois river.

The North Side plant utilizes the activated sludge process, in which the sewage is sent through screens and settling tanks, where most of the solids are removed. It is then turned into large basins where air is blown through it. This air starts a biological action in the sewage which destroys the impurities. After the aeration has been completed, remaining fine solids in the sewage are allowed to settle out in sedimentation tanks, and the liquid, which is then harmless, is turned into an adjoining channel.

Cleaning Settling Basins with Tractors

During the past year the Supply and Pumping Section of the St. Louis Water Works conducted an experiment in cleaning settling basins at the Chain of Rocks filtration plant. Teams and labor had been used heretofore in cleaning the basins but in the experiment tractors were employed instead of the teams. The results are set forth as follows by A. B. Smith, assistant engineer, in the recently issued annual report of Leonard A. Day, water commissioner of St. Louis.

The experiment fully justified the thought that a saving could be effected, and a request for the purchase of two tractors with pusher equipment will be inserted in next year's budget.

The following tables show a comparison in the cost of basin cleaning (labor and teams, Table I) for the past three years, as against the cost of cleaning (labor and tractors, Table II) for the year.

Average cost for removing 544,345 cu. yd. of sediment from basins, 2.4 ct. per cu. yd., or approximately $4,500.00 yearly with 20 men and 4 teams working 45 days.

Average cost for removing 309,649 cu. yd. of sediment from basins, 1 ct. per cu. yd.

In addition to the above there will be a saving effected by the use of less water and also the shorter period that the basins will be out of service, which will decrease the amount of added chemicals necessary to produce the required clarification, because of this shorter sedimentation period and smaller water loss. This saving in chemicals will approximate about $150 daily.

Table I

Year	Tons of Mud Removed	Cost	Labor and Teams
1924-25	197.637	$ 4,702.02	3 teams and 20 men
1925-26	174.345	4,412.25	4 teams and 21 men
1926-27	172,363	4,456.20	4 teams and 20 men
Total	544,345	$13,570.47	

Table II

	Tons of Mud Removed	Days Required	Cost	Labor and Tractors
Nov., 1927	167,224	21	$2,003.22	2 tractors and 16 men
April, 1928	142,425	8	1,003.86	2 tractors and 16 men
	309,649	29	$3,007.08	2 tractors and 16 men

Survey of Police Department

A survey of the police departments of 209 cities in the United States was completed recently by Lorna L. Lewis, an assistant in the Municipal Information Bureau of the University of Wisconsin Extension Division, and a summary of the results of her investigations is carried in a university press bulletin. In tabulating these results Miss Lewis divided the cities into five groups, according to population.

The tabulation shows that of the 209 cities surveyed, 66 per cent use civil service for getting recruits, 69 cities have training schools, six months is the usual probation period, 26 cities have a merit award system, 135 cities promote detectives from ranks of patrolmen, 91 per cent have a bureau of identification, more than 70 per cent have established an eight-hour day, and 25 cities have junior police in school districts.

No standard system of promotion was revealed by the survey. Salaries were also found to vary greatly in each group. In the bigger cities listed in the first group police chiefs received an average of $6,500, patrolmen a maximum salary of $2,160, and detectives an average salary of $2,400. In the second group average salaries were: chiefs $5,000, maximum for patrolmen $2,040, average for detectives $2,400. Similar classifications for other groups were: Group three, chiefs $4,000, patrolmen $1,980, detectives $2,100; group four, chiefs $3,500, patrolmen $1,800, detectives $1,900; group five, chiefs $3,000, patrolmen $1,740, detectives $1,800.

Expenditures for Paving in St. Petersburg, Fla.

Facts About Paving in Active Florida City

By Y. BRIDDELL
Georgia Engineering Co., St. Petersburg, Fla.

ST. PETERSBURG, known throughout the country for her miles of wide paved streets, entered the fiscal year July 1st, with two hundred and ninety miles of street paving of brick and block. The streets range in width from 20 to 60 feet with a greater portion between 40 and 60 feet. The greater part of the city's street paving program has been completed in the last six years, which saw a total of two hundred and ten miles laid.

The total mileage (290 miles) cost approximately $19,166,479.93. The first street was laid in the year of 1904 which was Central Ave. and is still in as good condition as when laid. This street is of brick, on sand base and sand filler.

The mileage shown in Tables 1 and 2 does not cover the streets paved in the sub-divisions, as they paved many miles themselves—which would increase the mileage shown. The approximate mileage done by private parties, will amount to twenty-five miles and as very nearly all of the sub-divisions have been taken into the city proper, the mileage in all to over 300 miles.

Assessments.—The cost of paving under ordinary conditions is assessed against the abbutting property on a front-foot basis. The property owner is given 10 years to complete the paving but under present conditions at least 30 per cent of the assessment must be paid in cash, with 10 years allowed to pay the remainder.

Paving is also financed through the issuance of 7 per cent paving certificates. These certificates are in great demand as secure and profitable investments for the person of average means. Each certificate represents the assessment on the individual lot or block of lots.

Table 1
Summary of Milage and Cost for Six Years

Year	Paving Mileage	Curbing Mileage	Cost
1923	12.45	24.90	$ 554,551.12
1924	29.49	58.98	1,418,095.45
1925	36.08	72.16	2,022,469.06
1926	63.82	127.64	5,751,519.70
1927	45.63	91.26	4,219,991.71
1928 (11 months)	22.70	45.40	1,639,852.89
Totals	210.17	420.34	$15,606,479.93

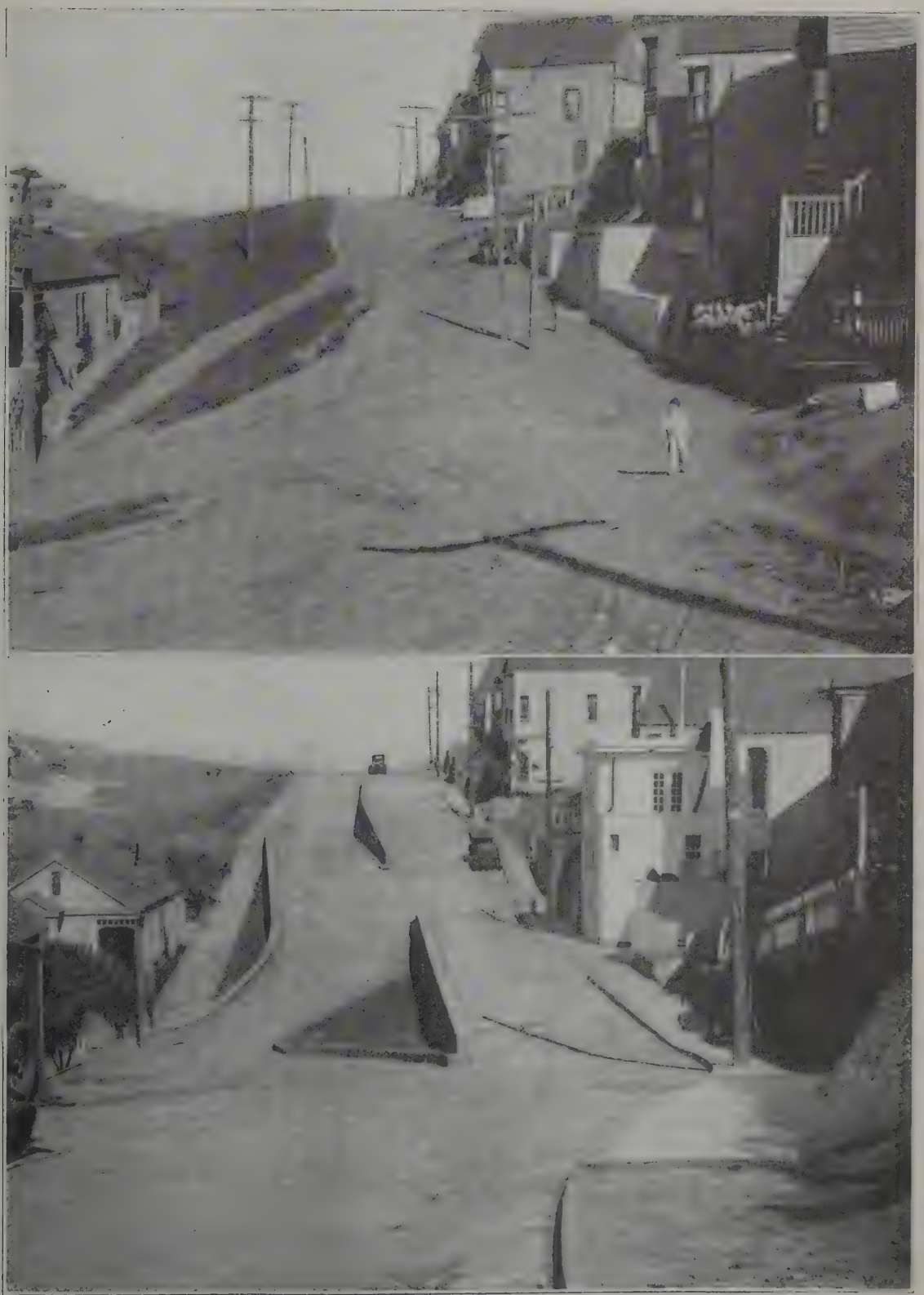
Table 2
Summary of Brick and Asphalt Block Streets Laid to Date

Brick streets mileage	216.00
Asphalt brick mileage	74.00
Total	290.00

Fig. 1—Beach Drive St. Petersburg Yacht Club Street Paved of Brick With Asphalt Filler

Fig. 2—North Beach Drive. Widened, Sand Base, Vitrified Brick Laid Flat, Asphalt Filler

Special Treatment Street Improvement at San Francisco, Calif.



Before and After Views of Special Treatment Improvement on Peralta St., San Francisco, Calif. The Two Roadways Match in Elevation the Adjacent Lots and Run on Travelable Grades to the Intersection on the Left

Street Sanitation at Chicago

Methods of Handling Rubbish and Garbage

By W. J. GALLIGAN
Assistant Superintendent of Streets, Chicago, Ill.

THE cleansing problem, as it affects great cities, is not a new nor modern one, but is as old as civilization. The daily cleansing of a great city is no small job. It is a Herculean task, involving the employment of a trained organization and the expenditure of a large sum of money.

Chicago, like all other great American cities, has a large cosmopolitan population. The city is spread over an area of 200 square miles; a city, twenty miles long and ten miles wide, with a population estimated at 3,156,400—divided into 630,000 families. They dwell on 4,000 miles of streets, 2,800 miles of which are paved.

City Divided Into 50 Districts.—For the purpose of government, Chicago is divided into 50 wards, and, as far as the work of the Bureau of Streets is concerned, each ward is in charge of a district superintendent. An office, equipped with a telephone, is maintained in each ward, and a clerk is on duty there during the day, where street matters may be inquired into and where complaints may be registered.

Garbage, ash collection and street-sweeping routes are laid out, and all the cleaning activities of the district are carired out from these ward offices.

On the south side of the city, garbage is taken to the municipal reduction plant at 39th and Iron Sts., where the grease is extracted and sold to soap makers, the residue being ground up and used as a fill for fertilizer.

On the north and west sides of the city, it is sent to the new, modern incinerator, recently erected on Goose Island, in the north division, and which was put into service in June of this year. It has a daily capacity of 600 tons of combined garbage and combustible refuse. Garbage is collected twice each week during the summer months and weekly during the winter. Approximately 104,000 tons are collected annually.

This is exclusive of hotel and restaurant garbage, which is collected and disposed of by private scavengers, under the supervision of the Department of Health.

It may be of interest to know that Chicago's garbage output falls far below that of other large American cities. This can be partially accounted for by the fact that all modern buildings are being equipped with incinerators and the household garbage destroyed on the premises.

Sanitarians show that we should produce about ½ lb. of garbage per capita daily. We fall about 35 per cent short of that figure.

How Ashes Are Disposed of.—One of the great problems that confronts large cities of the north is the final disposition of ashes and non-combustible wastes. In Chicago this class of refuse is dumped on low-lands and in abandoned clay and quarry holes, and in winter, when the output is more suitable for the purpose, it is extensively used in filling low streets and alleys.

Time was when the owner of these abandoned quarry and clay holes were anxious to get the fill and would take it without cost to the city, but, in recent years, with the city's rapid growth, most of the available holes have been filled, and as a consequence the city has been paying large sums where these holes were purchased, or where the "right-to-fill" was bought.

Refuse Paper Problem.—There is a class of refuse which makes for excedingly dirty streets and alleys, more than any other kind—refuse which brings much expense to the city—a kind which would cost householders, business men or individuals, nothing to dispose of, through channels of their own. That refuse is paper and combustible material. If burned by a city laborer, it is an expensive and dirty method of disposal. If carired away by a city wagon or truck, it makes a bulky load, enormously expensive in removal.

More than 3,000 tons of newspapers are distributed every day in the city of Chicago. Much of this becomes rejected material shortly after delivery. A single newspaper, carelessly thrown upon the street and separated by the wind, will litter a whole neighborhood. If we could control the throwing of waste paper on the streets we would be well on our way toward the solution of the "clean-street-problem."

While there is a city ordinance forbidding the throwing of waste paper or other refuse on the streets and alleys, it is probably violated thousands of times a day, without police interference.

Dirt from Controllable Sources.—A committee, appointed to recommend a more effective system of street-cleaning, declared in its last report that 30 per cent of the dirt collected by the street cleaning department came from sources that are controllable. Some of these sources are: overloaded coal, dirt and refuse wagons and trucks, building refuse, which contractors have only partially or improperly removed—overflowing refuse receptacles, house and store sweepings and waste paper. If a considerable percentage of the dirt on our streets and in our alleys may be prevented, as has been shown, it behooves city officials and citizens alike to see that the ordinances governing these violations are vigorously enforced.

Neglected streets and alleys mean punctured tires, delay and expense. Accumulations in alleys mean obstruction to traffic, loss of time. Dirty streets and refuse piles tend to grey, weary, hopeless feelings, while clean streets and alleys, on the contrary, make for courage, comfort and good feeling.

If a city is to be great and desirable to live in, it must have clean streets and alleys, free from refuse, and adequate revenue to obtain these should be secured.

Why European Cities Differ.—By those who have had little or no experience in the cleaning of a large municipality reference is frequently made to the cities in Europe, where ideal conditions prevail.

Of course European cities cannot be compared with cities in America. Their cities are populated by peoples of one nationality, speaking a common language, with like habits, customs and aspirations and, as a rule, easily controlled by the constituted authorities, while here, we have herded together in our large cities, all nations of the globe, bringing here their old-world customs, many of them having little conception of even the elementary laws of sanitation and failing utterly to give to cleansing officials that helpful co-operation that is so essential to the proper maintenance of clean conditions.

The Matter of Civic Pride.—To combat this, the Bureau of Streets officials are constantly on the alert to grasp every opportunity offered to stir the civic conscience and arouse civic pride, in an effort to make our people realize that they, too, have a responsibility; for, no matter how up-to-date the equipment, or how perfect the organization, streets and alleys cannot be kept clean unless the householders do their part.

I feel, therefore, that the public official who can successfully bring this point home to his people will make a long stride toward making and keeping his city clean.

The standard of cleanliness for streets and alleys in any city must, necessarily, be raised or lowered in accordance with the amount of money expended for cleaning purposes, and if those who guard the city's purse strings find it necessary to limit a city's expenditures in this regard, it is bound to be reflected in the cleaning service.

There are parts of Chicago that are always scrupulously clean, and are always kept that way, because the residents will it so. There are other sections of the city that are only passively clean, where the people would be clean if they easily could. There are other neighborhods that are constantly littered, in spite of all our efforts to keep them otherwise.

The situation in my city is no different than it is in every other large, and many small, American cities.

Acknowledgment.—The above paper was presented Oct. 9 at the Toronto Conference of the International Association of Street Sanitation Officials.

Accounting and Financing for a City's Utilities

Practices and Experiences of Municipal Plant of Kansas City, Kan.

By A. H. STRICKLAND
Commission Department of Water, Light and Power, Kansas City, Kan.

THE city of Kansas City, Kan., owns and operates its water and light utilities combined in one plant. The water works was purchased by the city from the Metropolitan Water Company in 1909 at a cost of $1,097,850. In financing the original purchase of the property, bonds were issued by the city and since that time bonds have been issued in the sum of $2,914,600 for extensions and improvements. Bonds in the sum of $349,600 have been retired and the outstanding indebtedness on the plant on December 31, 1927, was $3,362,000.

Financing Major Improvements.—The problem of financing major improvements in our utilities under the Kansas law is rather simple as to process but more or less embarrassing and uncertain as to results, as the foundation of all such financing rests on the popular vote of our electors. This feature places the management of the plant at the mercy of the whims of the voters and of the attacks of those individuals who may be opposed to municipal ownership or to the machinations of politicians who may seek to embarrass the officials in charge. As far as the Kansas City, Kan., plant is concerned, however, it may be said that the people of this city have always given the water plant generous support and its bonds have always carried by large majorities.

When the department engineers have made estimates of proposed extensions and improvements to the property, the board of city commissioners authorizes the mayor to issue his proclamation calling an election and the proposition of issuing the necessary bonds is submitted to the voters. If the result is favorable, the department is then in a position to proceed. Proceedings of the board of city commissioners are formed into a bond transcript which, together with specimen bond and financial statement is submitted to nationally known bond attorneys and the sale of the bonds made subject to the approving opinion of such lawyers. When the bonds are actually sold and the proceeds of such sale turned over to the treasurer, the money is placed in the extension fund of the department. This particular fund under the rules of sound operation and good business, is used exclusively for new work and is never diverted to operating or maintenance uses.

In addition to financing the major extensions as above set out, this plant has continually made improvements and minor extensions (which properly could have come from bond money) from the earnings of the department. In fact, up to August 1st, 1928, the sum of $727,043 was used in that manner and in addition to this $100,000 was recently transferred from the surplus earnings into the Extension Fund.

Fixing the Rates.—The state law under which this utility operates requires that such rates be fixed as will provide sufficient funds to cover all costs of operation, maintenance, bond interest, sinking fund and depreciation charges. In carrying out the intent and purpose of this act, the management of the property has gone even further than the statute contemplates. The plant has been operated succcessfully, it has been maintained as nearly 100 per cent efficient as is possible, interest on the bonds has always been met and all bonds have been paid at their maturity. A sinking fund has been established on a scientific basis that will adequately meet all future maturities and in addition, depreciation is being written off on a rate of 2.72 per cent. Over and above that necessary outlay the plant has been able to take care of many of its improvements through earnings as before outlined.

The Continuous System of Billing.—The department derives its ordinary revenue from the sale of water to its consumers, the rental of fire hydrants to the city government and from miscellaneous sources such as sales of meters, plumbers' permits, etc. In order that the department might realize quickly on the sale of water, the continuous system of billing was installed. The department has at this time approximately 27,000 water accounts which have been divided into ten districts consisting of 192 routes which routes are read continuously. Although meters are read continuously throughout the month the bills are so divided and mailed out that it has been possible to establish ten days throughout each month upon which the penalties for non-payment of bills fall due. These accounts are handled by automatic machines of the Burroughs type made especially to handle the style of bills used by the department. In addition to the 27,000 regular accounts, there are 500 commercial or large consumers which require individual attention and these bills are made by hand.

Reading Meters and Billing.—While the meters are being read, the addressograph department prepares a supply of bills for each district being read and upon completion of the reading, the billing is computed directly on the meter reading sheet. In addition to addressing of all bills, the addressograph department is also required to make a blank ledger sheet and meter reading sheet on all consumers. These sheets are made dircet from the addressograph plate. They are then forwarded to the ledger clerk, who makes corresponding entries on the ledger and meter sheets which are placed in their respective routes and the old consumers ledger sheets are transferred to the inactive file or the closed account file depending upon whether the consumer leaves an unpaid balance or not. In cases of unpaid balances, the charge is transferred to a history card file, arranged alphabetically by consumers' names and set up against the consumer which is collectible on the present service or in case of non-service, the balance must be paid before new service is given. All orders of consumers applying for service are cleared through this file.

The meter reading books having been billed are now ready for the billing machines, but they are first cleared by the control clerk, who balances each route monthly, checking all outstanding balances in the controls with the report from posters showing cash posted in each route which detects any errors in posting.

This method proves the correct balances of the ledgers for each route and the control clerk is able to spread the balancing of the ledgers over the entire month. As soon as the last route is billed, final figures for the month can then immediately be made up and they are then transferred to the general control ledger to be checked by the accounting department.

With the special machines now in use we can get the bills, ledger sheets and recapitulation of sales in one operation and are able to present the consumer with a neat, clean bill. By one operation we prove correctness of each bill before sending it out. If, by chance, the wrong keys on the machine should be used by the operator, the bills, ledger sheets and recapitulation sheets are

adjusted by the billing clerk as soon as this particular route is billed on the machine.

The machine records the following: the prior reading, the present reading, the consumption and the total amount of the bill. The proof is as follows: by subtracting the total old reading from the total new reading, the difference will prove the consumption billed. Distribution is then made from the recapitulation sheet as to the rates which sheet is used for the monthly report for water sold and finally used for the yearly report as to how the water was distributed according to the rates.

The Billing Machines.—The department has at present, three regular clerks operating the billing machines and is equipped with four machines. This gives us a surplus machine to be used in case of repairs being made on one of the regular machines. These machines handle approximately 95 per cent of all the accounts carried under the present system and the balance of the accounts being of such a nature that the bills must be made by hand. These regular operators average 800 accounts daily. This number includes, of course, a proportion of electric light bills that are gotten out by the same operator. Each district has a printed penalty date on the bills which makes it mandatory that the bills be prepared on time in order to allow each customer ten days in which to pay the bill after it is mailed and before the penalty is applied. This schedule of penalty dates for each district has been kept in force unchanged during the last six months, except in such cases as fall on Sundays or Holidays. The billing system now used in the commercial department of this plant has proven highly satisfactory because it has given regular periods between the bills and also enables the department to have the regular penalty dates but it has the greater advantage of getting the bills out with regularity thereby causing a better feeling on the part of the consumers and it also results in the department collecting the revenue quickly after the water has been used.

In connection with this system it would only be fair to say that the department had the benefit of the experience and advice of Price, Waterhouse & Company who planned this system to meet the conditions as they exist in this department.

Collections.—Collections are derived from three sources as follows: first, direct payment at the cashier's window; second, mail collection; third, through the different banks of the city. In the division of these collections we are able to ascertain any error occasioned by any one of the three sources. The record of the collections show each individual account number and amount paid. A collection sheet is made daily of all transactions and when completed they are passed to the billing department together with the stubs which after they are checked are used for posting purposes. Under the existing form of government in Kansas City, Kan., the city treasurer is custodian of all city funds. The water and light department cashier makes up his report and sends it to the city treasurer in triplicate. The original receipt is approved by the city treasurer and city auditor and returned to the cashier for future reference. At the end of each month a check is made between the water and light department and the city auditor and in this way balances between the two departments are continually maintained. Receipted stubs for cash posting along with collection sheets are received daily from the cashier and set up in numerical order showing the total collected for each route. These stubbs are then checked against the collection sheet and posted in their respective routes. After each route is posted, stubbs are checked against the ledger posting which verifies cash collected for each route. Individual route collections are then transferred daily to route control ledger where the accumulative collections for each day are used in balancing at the close of each month, to be checked by the accounting department. Routes are audited as penalty dates expire and unpaid balances are made in delinquent form and a delinquent notice is mailed to the consumer giving the amount of the delinquency and notifying the consumer that if the account is still unpaid after five days the service will be discontinued. The commercial office checks all stubs and miscellaneous receipt slips against the cash blotter furnished by the cashier. At the end of the month, the accounting department accounts for all the miscellaneous receipt slips that have been issued during the month. The accounting department posts from the cash blotter daily to the cash book giving each account its proper credit. At the end of the month cash balances of the different funds are checked with the city auditor who in turn has checked the daily collections which are turned over to the city treasurer by the water and light department cashier. The accounting department checks the credits to the various accounts with the cash book kept by the cashier. At the end of each month the commercial office furnishes the accounting department with the monthly comsumers' billing. This billing is charged to accounts, receivable consumers and the various income accounts are credited.

The commercial department is compelled to furnish the accounting department with a separate adjustment for each error that has been made when a customer has been over-billed. There are, of course, other adjustments that have to be made on account of errors, such as duplicate and erroneous collections. When all cash collections are taken from the cash books, all billing and all adjustments have been posted to the general ledger and the general ledger has been balanced, the balance of the accounts, receivable consumers account is checked with the control of consumers billing and this account and control must balance.

Recording Cost of New Work.—The work order system is used to record the cost of all new work, all miscellaneous work, all maintenance and operating expenses on automobiles and all maintenance on equipment when such maintenance on one job exceeds $200, with the exception of maintenance on boilers and stokers where the cost of the job must exceed $1,000 before a work order is necessary.

Procedure of issuing a work order is as follows: The general foreman or person in charge requesting that work be done furnishes the superintendent with a writen request giving an itemized estimate of the cost of the proposed job. This request is either approved or disapproved by the superintendent. If approved, the request is signed and given to the accounting department, an authorization and a work order covering the proposed work are then written. The authorization and work order are signed by the superintendent and the authorization is signed by the commissioner. The work and authorization are made in five copies. The original of the work order and authorization are used in the accounting department as posting records, two copies are given to the foreman, one copy is for the superintendent's file and the other copy is for the office file. Upon receipt of his copies, the foreman is then permitted to start the work and all labor and materials are charged to the work order number which has been issued. The accounting department posts this cost daily to the work order. Upon completion of the job the foreman returns one copy of the work order showing the date that the work was started and the date completed. The accounting department checks the charges to the work order with the estimate and any appreciable difference is checked with the foreman. After all differences have been accounted for, the work order is cleared with a journal voucher, the proper extension, miscellaneous, maintenance or operation account being charged and the work order credited with the amount accumulated on the work order. On the back of four copies of the authorization the difference between the amount estimated and the cost of the job is shown, one copy is given to the commissioner, one to the superintendent, one to the foreman and the other is for the office files. A removal work order is issued for each withdrawal of equipment from service. This work order is charged with the cost of removing the equipment and credited with the salvage value of the equipment. The work order is then charged with the original cost of the equipment which has been removed and the proper ex-

tension account is credited. The work order is then cleared, allowance for depreciation being charged and the removal work order being credited.

It might be well to mention that it has been the practice of the department to charge items to expense rather than new work where there is any question as to whether the cost of a job should be capitalized. It has especially been the practice to charge the cost of small betterments at the plant to expense and although the cost of each job taken by itself is inconsequential, there is no doubt but that the aggregate over a period of years is a substantial amount.

Acknowledgment.—The foregoing is an abstract of a paper presented Oct. 3, at the meeting of the Missouri Valley Section of the American Water Works Association.

Handling Complaints

How Special Bureau of Syracuse, N. Y., Functions

By MORRIS S. JONES
Deputy Commissioner of Public Works, Syracuse, N. Y.

The most important thing about the handling of complaints is a careful check-up of conditions under which you are operating. By this I am not referring to the machines used in performing the work, measured in horse power; but God's most wonderful creation, known as man power.

Some people, who are all to ready to take the measure of their fellowmen, hesitate to make an inventory of self. Personally, I have always liked the story of the negro boy who entered a drug store one day and asked the proprietor if he might use the telephone. He was told that he might, and after the boy had secured the desired number the druggist listened to the following:

"Is this Dr. Brown?"

"Dr. Brown, are you in need of a good colored office boy?"

"Oh, you say you have a good office boy."

"Thank you, Dr. Brown."

The boy hung up the receiver, thanked the druggist, and was leaving the store, when the druggist said: "Hold on boy. I'm in need of a boy to run errands, and if you are looking for a job I'll hire you.

"I'se not looking for a job, boss."

"Why," said the druggist, "you were just asking Dr. Brown for a job as office boy."

"No boss, I was not asking for a job. I'm Dr. Brown's office boy, and I just was checking myself up."

We hear a great deal about measuring men, but in the final analysis the value of any individual is measured by his work, minus his need of supervision, minus his error.

It is right here that men at the head of big business in all lines experience most trouble, which is that of getting the men under him to realize that their work or value is increased as the necessity for being watched is decreased, because they can profit by yesterday's errors and not make them a part of today's and tomorrow's work.

I have found that one of the great difficulties in attempting to give perfect service in the public works department is due to the fact that so many of the employees deem themselves unimportant cogs in the machine.

During the late World War a negro appeared before a drafting board in one of the states, and was asked by the examining officer if he had any one dependent upon him.

"Yas suh," he replied.

"Are you married?" No, suh."

"Are your parents living?"

"Don't know as I ever had any, boss."

"Well then, who is dependent upon you?"

"The firm I works for is dependent upon me, boss."

That is the spirit that must be in every man and in the department to make for efficiency and the reduction of complaints, which to my way of thinking is an important factor in the handling of complaints.

It is a well established fact, however, that as long as we must deal with the human equation errors will occur, and as a result of same cause complaints, which makes it necessary that we evolve some system to care for same.

An old adage, full of truth that cannot be denied, says: "What is everybody's business, is nobody's business."

Hon. Charles G. Hanna, the mayor of Syracuse, N. Y., in the beginning of his first term realized the truth of that statement, and in order to properly and promptly handle the complaints he established a bureau of complaints with a secretary in charge. All complaints, whether received by letter or telephone, are registered on a triplicate card. The original card is filed with the bureau, the first copy, which is pink in color in order that it may not be easily lost among other things, is sent to the commissioner, and the other copy to the mayor.

If the complaint is one dealing with the non-collection of garbage or ashes, the secretary of the bureau immediately telephones to the superintendent of that department, who arranges for an emergency collection. This also gives the superintendent the opportunity to investigate the cause of this apparent failure on the part of his men.

As all these complaints are sent to the commissioner he is able to tell at the end of each week not only how many emergency collections have been made, but the reason for the failure in each instance, and when holding his weekly conference with his superintendents and department heads can counsel on means to correct such matters.

In the matter of complaints covering such things as loose manhole covers, catchbasins needing attention, repairs to dirt streets, etc., the deputy commissioner having immediate charge of such matters makes a personal investigation and arranges the remedy for same.

When a complaint has been properly handled the person who has done the work makes such notation on the remarks line and returns it to the commissioner. The card is then sent to the bureau of complaints, and after the secretary has made proper record for his file he sends it to the mayor, who in turn writes to the complainant telling that person that it is his understanding that the matter of which he complained has been properly cared for. In this way the administration keeps in touch with complainants as well as complaints.

It is a fact well known to you all that not all the complaints received are justifiable. In other words, the department is not at fault for the failure to render service. Take the matter of the householder who fails to put out the barrel of ashes in time for its transfer from the rear of house to the street for collection, and then after the trucks have finished work on that street, calls on the phone to say that the man has failed to take my ashes.

Even in complaints of this nature, we have worked out a scheme whereby the man of the department failing to find the barrels of ashes or the garbage out in its usual location leaves a printed card, in the mail box, calling attention to the fact that no barrel was out for collection. They also turn in a record of such homes at end of day.

It was the immortal Lincoln who said "A drop of honey catches more flies than a gallon of gall," and so, in handling complaints, whether justifiable or not, we have found that courteous treatment of the complainant, sending the man who can put a smile into his service, helps to establish helpful relations between the administration and the citizens of the city.

Acknowledgment.—The above paper was presented Oct. 9 at the Toronto conference of the International Association of Street Sanitation Officials.

Seeks More Funds for Mosquito Control.—The Essex County, New Jersey, Mosquito Extermination Commission will ask the County Freeholders for an increased appropriation to fight mosquitos next year. The amount will be $101,000. The amount this year was $81,850. The additional funds sought will be used to employ more inspectors in the house-to-house campaign during July and August. Heavy rains last summer gave too much work to the half-dozen men employed and the number will be increased to a score if the appropriation is authorized. The commission agreed that yards were more of a menace in wet weather than had been believed.

Cost of a Sewer Dug by Hand

Data on Small Job at Elsmere, Del.

By SAMUEL VADNER
Engineer, Wilmington, Del.

THE Oak Grove sewer starts from the septic tank of the Oak Grove School, Elsmere, Del., and runs 1,285 ft. to Chestnut Run, discharging in the open stream. It is wholly a sanitary sewer, handling the discharge from the septic tanks only, except for some rain water from the Oak Grove School at the upper end, which was included with the idea that this water would act as a flushing stream for the sewer. The upper 700 ft. of the sewer is 8-in. T. C. pipe and the lower 585 ft. is 10-in. T. C. pipe, all with cemented, wiped joints and laid to a uniform grade of 9 in. per 100 ft. There are 6 brick manholes.

General Features.—The job was awarded to the lowest bidder, who was 15 per cent under his next competitor. The low bid was due to insufficient previous experience of the contractor at this phase of contracting, as a result of which he did not figure the estimate accurately. All digging was done by hand, using colored labor working a 10-hour day at $0.40 per hour. Five weeks were required to complete the work. The average depth of the trench was 6½ ft. The subsoil was red clay with occasional stratas of water-bearing gravel. Only a slight amount of trouble was occasioned by water and this was chiefly after two heavy rains. Approximately 800 cu. yd. of dirt were excavated, including that for manholes.

An 18-ft. concrete base road was dug through, as was a double line of street car tracks. Except for 200 ft. of the line along the edge of a field, the balance of the distance was along two cinder topped dirt roads. Due to the solid nature of the ground it was unnecessary to sheet any of the trench. The average width of trench was 30 in., although specifications would allow a minimum of 6 in. on either side of a pipe bell which would result in a minimum width trench at the bottom of 24 in. for 8-in. pipe and 26 in. for 10-in. pipe.

Explanation of Cost Items.—The contractor lost $398.96 on this job, or 15 per cent of the total contract price of $2,644. The loss did not include some small further overhead loss such as interest on money, office expense, etc. However, of the labor charged under the heading of "foreman" $72 was done by a brother of the contractor who drew no pay, but worked only for a share of possible profits. Of "equipment hire" only the items of $15 for use of the air compressor and drill, and $5 for centrifugal pump hire, were paid out in full, as the remaining equipment belonged to the contractor and would probably have stood idle if not used on this job. For the purpose of job cost accounting the equipment is charged against the job at current renting rates for the same or similar equipment. Of the remaining $252 charged as "equipment hire" probably $60 represented a profit to the contractor using his equipment on this job rather than have it idle. This $60 contingent credit plus the $72 labor credit would reduce the contractor's loss to $267 or 10 per cent. As there were 15 houses along the line of the new sewer, the contractor expected to get a number of profitable small jobs without much competition installing septic tanks for these houses and connecting them to the new sewer. Only one house owner had this done while the main sewer was being put in and the profit from this source was negligible.

The job included at the lower end a 60-ft. concrete retaining wall containing 17 yd. of 1:3:5 concrete.

The cost of the work was divided as follows: Labor 69.2 per cent, material 21.0 per cent, equipment hire 8.8 per cent, insurance 1 per cent. From observation ⅝ of the laborer's cost of $1,712, or $1,070, was for excavating, some dirt being handled twice, due to the depth of trench.

Conclusions.—The labor cost precluded the contractor from any chance for profit. There was a trench digging machine within a few miles which could have been hired to dig all the trench except the street and car track crossing. The only pipes encountered were two 1-in. gas pipes. A trench machine could have cut 1,200 ft. in 10 working days at a rental of $40 per day including fuel and operator. This expenditure of $400 would have reduced the $1,070 estimated excavating cost to $670, allowing $270 for cleaning up the trench after the machine and excavating the car track and road crossing. A further saving of $12 on insurance and $77 in foreman's wages by shortening the time from five to three weeks would have been effected. This total saving of $499 would have turned the $398.96 loss into a profit of $100.04 or 3.2 per cent.

Cost Data.—The cost of the work was as follows:

Labor:		
Laborers 278 men-days at $4 (10-hour day)	$1,712.00	
Night watchman 4 nights at $4	16.00	
Foreman 34 at $7 a day	238.00	
Bricklayer (union) 7¾x8 hours at $1.62½	102.00	
Formsetters 7x9 hours at $1	63.00	
Total labor		$2,131.00
Equipment Hire:		
Trucks (1½-ton) 18x10 hours at $1.25	$ 225.00	
Tractor grader 4 hours at $2	8.00	
Air compressor and paving breaker 3 hours at $5	15.00	
Concrete mixer, 1 bag, 1½ days at $6	9.00	
2½-in. diaphragm handpump	10.00	
2-in. centrifugal pump 5 days at $1 per day rental	5.00	
Total equipment hire	$ 272.00	
Material:		
174 sacks cement at $3 a bbl. del. (in paper)	$ 130.50	
6 sacks Lumnite cement at $2 for 8-in. street crossing base	12.00	
6,000 common bricks at $25 per M	150.00	
6 manhole frames and covers at $26 (Lobdell Foundry, Wilmington)	154.00	
11 yd.—15 tons concrete sand at $1.40 ton not incl. hauling by contractor's truck	22.40	
7 yd.—10 tons plasterer's sand at $1.50 ton not incl. hauling by contractor's truck	15.00	
6 yd. cinders at $0.50 (not incl. hauling done by trucks charged under labor)	3.00	
1 ton Amiesite 10 sq. yd. 2 in. thick in place at $1.70	17.00	
Gasoline and oil for pumps	2.40	
Form lumber 1x6 and 2x4 1,800 B. M. at $36	54.00	
24 yd. gravel (1-in.) at $1.75 per ton, 2,600 lb.—1 yd. (20 yd. for wall, 2 yd. for street crossing base, 2 yd. M. H. bottoms)	54.60	
8½ yd. used paving brick and brickbats (hauling charged under labor)	N. C.	
2 two-ton truckloads of old lumber incl. 3x12-in. used in 6-ft. lengths for placing every 25 ft. across trench and nailing grade stakes to	N. C.	
6 individual "tin" pipe forms for manhole inverts in place	18.00	
Total material	$ 647.90	
Summary:		
Contract cost of job		$2,590.00
Extras, manhole $75, 10-in. pipe instead of 8-in.—100 ft. and 5 extra wyes at $0.63 (all fittings cost double price of pipe)		93.90
Equipment hire	272.00	
Labor	2,131.00	
Material	647.90	
Insurance—workmen's compensation 1½ per cent payroll	31.96	
Loss		398.96
Total	$3,082.86	$3,082.86

Meetings of National Highway Traffic Associations

The following meetings of the National Highway Traffic Association of which Elmer Thompson, 12 East 53rd St., New York City, is secretary, is scheduled for the near future.

Dec. 3. 1928—Meeting of the South Central Division of the National Highway Traffic Association, New Orleans, La.

Dec. 10, 11 and 12, 1928—Annual meeting of the National Highway Traffic Association at the Automobile Club of America, New York City.

Jan. 16, 1929—Meeting of the North Central Division of the National Highway Traffic Association, Cleveland Hotel, Cleveland, Ohio.

Pave First, Then Put in the Curbs—A New Municipal Paving Method

Chicago Board of Local Improvements Tries New System Reversing Old Method

A REVERSAL of established practice in municipal paving work is being tried out on current concrete paving work under construction by the Board of Local Improvements, in the City of Chicago. Ordinarily, as every reader knows, it is the custom to dig a trench for curb and gutter, on such improvements, then to lay the combined curb and gutter, and then follow with the grading for the street. Under the new system under discussion the entire grading is first done, side forms erected, and the pavement laid, and the curb is then put in last of all. The main idea seems to be to afford a well graded and compacted subgrade for the curb under the same operation that provides for the pavement slab, and to permit the use of the finishing machine on city work. The latter method was not used on the job observed, but could be applied. The method gives rise to certain difficulties that will have to be solved before the new paving sequence may be said to be developed to the point of practicability. At the same time the idea seems to be worth further development. Comments on possible improvements will be made at the end of the article.

Left—Form Work Along Street Car Tracks. Right—Form Work, Bracing and Dowels Along Curb Line

The Job.—The job on which the new idea was observed was on the paving of Division St., in Chicago, between Cicero Ave. and a railroad viaduct about 875 ft. east of that street intersection. The center of the street is occupied by two street railway tracks, paved between the tracks with granite block on sand-grout cushion and concrete base, and 5 rows of block between the outer rails and the new pavement. Except for this latter strip of block, this street railway work was not disturbed. The total width of the improvement is 42 ft., less the 16 ft. surface line right-of-way, or two 13 ft. strips, one on each side of the right-of-way, plus an extra 3-ft. strip on the north to be laid under private contract with the abutting property owner, a manufacturing concern. The new slab is 10 in. thick. The curb, dowelled into the pavement, was designed for a width of 10 in. at its base, a height of 15 to 20 in., and with the face battered from the slab surface to the top of the curb 2 in., giving a thickness at the top of the curb of 8 in. A groove at the intersection of the curb face and the top of the pavement slab is filled with asphalt to make a water-tight joint. The slab has expansion joints placed at 30 ft. intervals.

General View of Placing and Finishing Operations

Grading Methods.—Grading on the job was done with a P&H ½ cu. yd. gas shovel, loading into motor trucks, which hauled the spoil to the dump. The grading crew included a shovel operator, 2 pitmen, 2 flagmen (for warning the street cars) and the grading foreman. An existing concrete slab at a drive intersection had to be removed with concrete breakers. An Ingersol-

The Spaders and Finishers at Work

Rand compressor in a motor truck body supplied the power for one breaker, and this work was supplemented by four laborers with picks and shovels. The grading was done beyond the back of the future curb so that no great amount of hand digging would be required.

Setting the Forms.—Wood forms were used on this job. These forms were made up of 2x10 lumber, supported by stakes driven on the outside at intervals of 5 to 6 ft., and braced by stakes running diagonally downward and outward from the tops of the forms to other stakes driven on the edge of the subgrade, in the case of the forms at the curb line. In the case of the forms next to the rails, these diagonal braces were butted up against the granite block remaining in place along the rail. Before setting the forms, ¾-in. holes were drilled through the forms with a brace and bit, at 3-ft. intervals, for the dowels. After the forms were laid to line and grade, the dowel bars were slipped through these holes and concrete was laid. These dowel bars were ¾ in. reinforcing bars, cut 24 in. long, and placed in the forms so that 18 in. of the bar would lie horizontally in the slab, and 6 in. would project into the curb.

Laying the Concrete.—The next step was to lay the concrete pavement. This work was carried on much as usual. The paver used was a Multi-Foote 27-E paver, served by 3-batch motor trucks owned and operated by the material firm and delivering the batches from the nearest material yard. The concrete was deposited on the subgrade from the boom bucket, puddled, and then finished with a perforated roller, belt and floats. The concrete crew included a foreman, 2 mixer operators, 6 puddlers, 2 men on the subgrade, 2 men on stakes, etc., 2 men on the roller, and 3 finishers. The concrete specified was a 1:3:6 mix, with 4.2 sacks of cement per cu. yd. of concrete, with 5.2 gal. of water to the sack of cement, and a mix of not less than one minute. The observed mix was 70 seconds. Since this was to be a two-course pavement with granite in the top, the delivery of batches had to be arranged so that the top mix could be deposited on the base mix and the two puddled together before finishing.

This organization was able to pave 630 lin. ft. of one strip during the first 8-hour day, and the entire pavement was laid within two days.

Stripping the Forms.—The curb was laid a week after the slab was completed. This required the stripping of the forms within four or five days. To strip the forms, the braces were first removed, and with a timber and picks, the forms were then loosened and pried off. In spite of the bars protruding through the holes in the forms it was possible to salvage a large proportion of the form lumber, although some was so damaged as to be fit for nothing but kindling wood. After forms were stripped, a plank was used as a lever to bend up the end 2 in. of each bar so as to form a hook to give better bond in the curb.

Setting the Curb.—Curb trenches were then cleaned of any dirt and other material that had fallen in during the paving, a back form and face form were set, and the curb poured in much the usual manner.

Comments.—While fundamentally the idea appears to be sound and feasible, it is true that the preparation of the forms requires a bit of extra labor, and that it is difficult to strip the forms prior to the laying of the curb. Little re-use of forms would be possible, and on a large job this would be of importance. It might be better to notch the forms for the bars and use some sort of filler strip along the bottom edge to prevent loss of concrete through the notches. Then, in stripping, the form might more easily be stripped without damage by simply prying it upward with two or three levers, or by one man lifting one end at a time.

General View of the Paving Operations

Should steel forms be used, the bars could be fabricated bent and placed on chairs with the shorter end placed against the inner face of the form. The forms could then be stripped just as on a rural highway job, and the bars later straightened out. Some such provisions, at any rate, could be worked out, it is thought, to make this a more practical paving method.

Those Responsible.—This paving work was done under special assessment for the Board of Local Improvements, City of Chicago, under the direction of John B. Hittel, chief structural engineer, and H. A. Fixmer, division engineer, and John C. Vesely, junior engineer, with the work supervised by L. G. ("Larry") Harmon, resident engineer, F. W. Linsey, general inspector, and T. Coleman, inspector. The contractor doing the work was the Peter J. O'Brien Co., represented on the work by J. S. Hegel, superintendent.

The Prolific Turkey Buzzard and the Water Tank

In a discussion of a paper presented at the last annual convention of the Southeastern Water and Light Association Mr. J. E. Gibson, manager and engineer of the Commissioners of Public Works of Charleston, S. C., told what happened in his city as the result of the failure to build a cover on a water supply tank. We quote from his discussion:

Charleston is an old town. She loves tradition. In fact, without tradition Charleston would not be Charleston. Not only South Carolina, but a great many other states have laws for the protection of turkey buzzards. But recently it has been found that the buzzard is also a carrier of bacteria and a spreader of disease, particularly the hoof and mouth disease so prevalent many years ago. So the laws protecting the buzzard were repealed, and today you can shoot a buzzard without any special license. But close to our tank was a man who runs a pig farm. He fed the pigs from the swill from our town. It is in the city limits and against the city ordinances, but he got away with it. The buzzard found that was easy picking, as he did not have to forage for a living. The moment the buzzards got busy with the pigs the owner got out with a shotgun and shot buzzards. One of these buzzards was injured and tried to light on the tank. We had fixed the tank at the top so that it afforded no footing. He was injured, tried to light, went over and was drowned. We got him out, but in fishing him out somebody saw him. About thirty days later a second buzzard had the same thing happen to him. This second buzzard landed in the tank and we had to fish him out. I don't know what the reproductive capacity of those birds is, but those two dead buzzards were very prolific, and one man went so far as to go before the grand jury and testify that he had seen no less than 26 buzzards taken out of that tank. It finally got up to 97. That is the highest story I got.

In not covering the tank we save about $8,500. That looked pretty good to us at the time, when we were spending $92,000. It looked like an 8½ per cent saving, but after this turkey buzzard acted as he did, you know I went before the board and asked it for $10,000 to put a cover on the tank, and I got it. I was not particularly fond of buzzard water. I was not particularly fond of this news being spread about, and for it to be known that we did not cover the tank in the first place. When the grand jury came into court, the judge was a rather sane man.

He said, "Have you consulted the superintendent of the water department?"

"No, sir; we thought we would bring out a bill and order the commission to cover the tank."

He said, "I would not do it that way. Before you do anything I think you ought to go up and see Mr. Gibson and see what can be done."

When they came I told them what had been done. I showed them that I had permission to put a covering on the tank, how the story about those buzzards had grown.

As a measure for the protection of health I believe it is best to cover your tank. And having filtered the water and pumped it into your basin, I think it is best. We spent about $9,000 or $9,300 to cover the tank, so we lost about $300 by not covering it in the beginning. If you want to build a tank put a cover on it.

New Company Incorporated to Acquire Water Works in Various States.—The National Water Works Corporation has been chartered under the laws of Delaware with a capitalization of 200,000 shares of cumulative preferred stock, no-par value; 200,000 shares of class A common stock, no par, and 200,000 shares of no-par class B common stock. The corporation has already acquired a number of properties in Pennsylvania and Tennessee and other acquisitions in various states are now under negotiation. The officers of the corporation include I. Edgar Detwiler, president of Detwiler & Co., president; V. Bernard Siems, formerly vice-president of North American Water Works Corporation, vice-president; William H. Urban, vice-president of Detwiler & Co., vice-president; Eugene L. White, formerly vice-president and general manager of New Jersey Power and Light Company, vice-president; H. A. Yerkes, vice-president of Detwiler & Co., Inc., vice-president; John Patterson, senior member of the firm of Patterson & Brinckerhoff, secretary, and C. E. Lent, formerly treasurer of North American Water Works Corporation, treasurer.

Neptune Meter Company Official, J. Bayard Kirkpatrick, Dies

The death of J. Bayard Kirkpatrick, vice-president of the Neptune Meter Company, New York City, was announced by radio from the S. S. Rotterdam, two days out from New York, on September 10th.

Mr. Kirkpatrick underwent a serious operation at the Harbor Hospital on May 8th, but had shown such a satisfactory improvement that he left New York with Mrs. Kirkpatrick for a trip to Switzerland, where he expected to spend some time convalescing. The announcement of his death came as a great shock to his many friends in all parts of the United States.

J. Bayard Kirkpatrick

Born in 1872, the son of Judge Andrew Kirkpatrick of the United States Circuit Court, he was graduated from Harvard University in 1894, and Harvard Law School in 1897. After becoming a member of the New Jersey bar he opened a law office in Newark, N. J. From 1900 until 1926 he served the Neptune Meter Company as secretary and director. In 1926 he was elected first vice-president of this company. He was also vice-president of the Neptune Meter Company, Limited, Toronto, Ontario.

In addition to his business activities, Mr. Kirkpatrick was well known as a dog-fancier but gave up his kennels at the time the United States entered the World War.

Mr. Kirkpatrick was a past president of the Water Works Manufacturers Association, and at the time of his death was vice-president of the American Water Meter Institute. He was a member of the Harvard Club.

The S. S. Rotterdam returned to New York on October 5th with the remains and funeral services were held from Mr. Kirkpatrick's late residence at West Caldwell, N. J., on Sunday, October 7th, at 2:30 p. m.

Court Decisions Relating to Sanitary Matters

Recent Rulings of State Supreme Courts

City Held Liable for Sewage Pollution of Stream.—(Oklahoma Supreme Court; City of Enid v. Brooks, 269 P. 241; decided July 24, 1928.) An action was brought against the city of Enid to recover damages for the pollution of a stream which extended into plaintiff's premises. The plaintiff alleged that the city had negligently operated and maintained its septic tanks and sewer system, and that the sewage, emptied from the septic tanks into the stream to the injury of the plaintiff. It was further alleged that the plaintiff had been forced to abandon the dairy business because of the pollution of the stream, although her farm was specially suited for dairying purposes. A jury returned a verdict in favor of plaintiff and judgment was rendered thereon. On appeal, the city objected principally on the grounds that the evidence was insufficient to support the verdict and that the verdict was contrary to the evidence and the court's instructions. Regarding these objections the supreme court said:

* * * We think there was ample evidence of failure to use ordinary care in the maintaining and operating of the sewer system during at least the greater part of the two years covered by this suit.

* * * We think there can be no doubt but that the evidence is sufficient to raise the issue of failure to use ordinary care, on the part of the city, to show a causal relation between the negligence and the injury complained of, and to also show a substantial injury to the usable value of plaintiff's home and farm, and also a damage by reason of the discomfort, annoyances, and personal inconveniences caused plaintiff by the defendant. * * *

The city further contended that the negligence of the city's officers in the disposition of the sewage of the city was not a negligence of the city in its corporate capacity, for the reason that the operation of the sewer system was a governmental act which did not render the city liable for such negligent acts. The court's conclusion on this point was "that the city is liable to a riparian owner for damages sustained by reason of the negligent operation of a municipal sewer system by its officers and agents."

Still another contention of the city was that, since the evidence disclosed that the stream was polluted by storm sewers which drained areas about various industrial plants, etc., the plaintiff was not entitled to recover. But the court stated that "The fact that the stream may have been polluted from other sources would be no defense to a recovery for any damages caused by its act."—Public Health Reports.

City Held Liable for Sewage Pollution of Spring and Lake.—(Missouri Supreme Court, Division No. 2; Windle et ux. v City of Springfield, 8 S. W. (2d) 61; decided June 21, 1928.) An action was brought against the city of Springfield to recover damages for the pollution of a spring and lake on plaintiffs' land. A jury found that the pollution was due to percolations from a sewer connection installed by contractors employed by the city. A judgment in favor of the plaintiffs was rendered by the trial court, and this judgment was affirmed by the supreme court on appeal. The reasoning of the latter court is shown by the following excerpts from its opinion:

The question of the defendant's liability under the facts in this case does not depend upon the character of its act in ordering the installation of this sewer. That it was constructed under its authority it concedes, and defendant contends that its act in so doing was not ultra vires. We are therefore confronted with this state of facts in determining the defendant's liability: Was the control and use of the sewer after its installation and during its operation such as to cause the damages complained of by the plaintiffs?

However uniform the rule may be as to the nonliability of a municipality for acts in the exercise of its governmental or legislative capacity, it does not apply when the municipality makes such a use of its own land after the construction of a sewer as to constitute, as at bar, a private nuisance. Here the sewer was constructed upon the land of the city. In its use sewage flowing through the sewer percolated the adjacent soil and contaminated the plaintiffs' spring and lake, rendering the water of same unfit for domestic or other use and laden the air with foul odors.

This general rule, sanctioned by many courts of last resort, may, under the facts at issue, be held applicable in the determination of the instant case; if a sewer, whatever its plan or the conditions under which it was installed, is so constructed as to cause a positive and direct invasion of the plaintiffs' property by percolating the soil in such a manner as to contaminate the owner's water to such an extent as to render it unfit for use, then the city may be held liable in an action for damages arising from such injury. * * *—Public Health Reports, Sept. 26.

Power of State Board of Health Regarding Markets.—(Louisiana Supreme Court; State ex rel. Saint, Atty. Gen., et al. v. Mayor and Commission Council of New Orleans, 118 So. 30; decided July 2, 1928.) A suit was instituted by the attorney general and the president of the State board of health praying for a writ of mandamus commanding the commission council of the city of New Orleans to provide properly equipped and constructed sanitary markets in lieu of the 16 markets then owned and operated by the city. The judgment of the trial court directed the mayor and commission council to construct and properly equip sanitary public markets to take the place of certain enumerated markets. On appeal the supreme court reversed the judgment of the lower court and denied the application for mandamus. The conclusions reached by the appellate court are set forth in its opinion:

The law provides ample means, other than by mandamus, for correcting and preventing a recurrence of the conditions complained of by the relators. An injunction restraining the commission council from operating unsafe or unsanitary markets is an expeditious, effective, and proper procedure. It is a well-recognized rule that mandamus will not lie if there be other adequate legal remedy open to relators for the enforcement of his demands. * * *

In this case the respondent might well admit that the State board of health, under the constitution of 1921 (art. 6, sec. 11) and the jurisprudence of this State, has plenary power to enforce sanitary regulations in publicly operated city markets without injury to its cause, for the power of the board to regulate the use of the city markets does not include the power to control the discretion of the commission council to repair, or to discontinue the use of, or to demolish and rebuild, its markets. * * *

It seems clear to us that, while the State board of health has the power to restrain, by injunction, the use of any market, whether publicly or privately owned and operated, until its sanitary code is complied with, it has no power to control by mandamus, the direction of the commission council with respect to its disposition of municipally owned property. * * *—Public Health Reports, Sept. 26.

Liability of City for Negligent Disposal of Sewage.—(Oklahoma Supreme Court; City of Sayre v. Rice, 269 P. 361; decided July 31, 1928.) An action to recover damages, based on the negligent operation of a sewer system, was brought against the city of Sayre. The plaintiff alleged that the main line of the city's sewer system became broken and that the sewage, originally intended to be emptied into a river, was discharged upon the bottom lands of the river in the near vicinity of plaintiff's land and home, causing loss of rents and discomfort, annoyance, and illness to her and her family. A jury returned a verdict in favor of the plaintiff, and the city appealed. The nature of the evidence presented by the plaintiff to substantiate her claim for damages on account of sickness, alleged caused by the nuisance, is stated thus by the appellate court:

* * * Plaintiff's evidence merely showed that the city sewer discharged the sewage upon the ground about 200 or 300 yd. from her home, where the same was not carried off during dry weather by the water, and that certain sickness, including typhoid fever, occurred in her home. There was no evidence reasonably tending to show that the nuisance caused any of the sickness or fever. No evidence was even offered that the sickness would not likely have resulted from other causes, and that the discharge of sewage contained such disease germs as would create the disease complained about. There was no opinion given by expert witnesses that such condition would likely result in typhoid or other fevers; and, in so far as the record discloses, one would have to rely solely on conjecture as to what produced the fevers testified about. * * *

The supreme court held that, because of this state of the evidence, the matter of sickness should not have been submitted to the jury as a proper item of damage, and remanded the cause for a new trial, saying:

* * * Without the aid of some proof as to the causal relation between the nuisance and the injury, a jury would be licensed to enter the field of conjecture, which, in many cases, would result in unjust and untold injury to the parties litigant. It can not be ascertained from the record whether the amount of the verdict, in excess of the rentals allowed under the special interrogatories, were because of the noxious odors to plaintiff and her family or because of the typhoid and other fevers about which testimony was given. The item of sickness having been submitted to the jury as a proper item of damage, it is reasonable to suppose that some compensation, and possibly the greater part thereof, was allowed by reason of such sickness. Under the record, this item should have been excluded, and it was error to refuse the requested instruction.—Public Health Reports.

The Construction of a Distribution System

Methods and Practices at Council Bluffs, Ia.

By C. L. EHRHART
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IT will be assumed that the design of the proposed project is according to good practice and that the materials have been ordered. Therefore the first operation that confronts us is the handling of the pipe from the car.

Handling the Pipe.—Under no circumstances should pipe be allowed to drop or swing against anything that will cause it to crack. It should be handled by means of skids, or better yet, by derricks or cranes which can swing it clear of all obstacles and deposit it without undue jar wherever required. For use in handling small pipe, the writer has found the best method to be by means of a derrick having a 10-ft. boom and mounted on a heavy truck. This derrick is of a type generally advertised, and is inexpensive to buy and can be used for handling many other things than pipe. Such a derrick can even be mounted on the side of a freight car, if it is not convenient to mount it on a truck, and then taken down after the car is unloaded. As soon as the pipe is lifted from the pile, it should be sounded for defects, then swung around and lowered. It is not always possible to lower the pipe directly to stock piles, but several lengths can be laid crosswise on the truck back of the derrick and taken over to the stock pile and put in place quickly. Probably the handiest and neatest stock pile is one in which the pile alternates in the placing of the bell and spigot ends with each layer turned 90 degrees in direction. Such a pile is not liable to slip causing breakage or accident and is handier to check. Many times the pile can be loaded directly to the trucks or trailers and taken to the point where it is to be laid. In the case of large pipe it is often economical to have some company equipped with large stationary booms do the handling. In Council Bluffs we are fortunate in having a bridge company which will unload large pipe to our trucks and trailers at $5.00 per car.

Delivering Pipe to Job.—We have found it most economical to deliver pipe to the job by a truck pulling a trailer where possible. Trailers are rather inexpensive affairs, and we believe no water department should be without one or more. We have been able to haul from 4 to 5 tons on a single trailer in addition to the pipe on the truck. In removing pipe from the truck or trailer to the ground, care should be taken that there is no chance of breakage. On dirt streets it is possible to slide the pipe off the end without damage, but on paved streets such a practice cannot be carried out. We have found it best to lower pipe on paved streets with the above mentioned derrick mounted on a truck. As this truck is also used in lowering the pipe into the trench, it is not necessary to string the pipe with the bell ends one way, for it is a small matter to swing a pipe around when suspended from the boom. We have also had occasions when it was not advisable to string the pipe at all, but to pile it on the parking at convenient locations. In this way it can be stored longer without complaint from the public and without the danger encountered by stringing the pipe in the street. As the pipe has to be picked up by the truck for placing in the trench, the short run necessary to take it from the pile to the trench, does not noticeably hold up the work as would be the case of handling by hand.

Digging the Trench.—With the material on the ground, the next operation is making the excavation. Some of the larger cities are fortunate enough to have trenching machines, but in the smaller or medium sized cities, we believe most of this work is done by hand. In either case the trench should be dug wide enough to allow the back filling material to slip past the pipe and fill the lower quarters below the pipe. If a ditch is cramped for width, the back filling material is likely to rest upon the top of the pipe causing an undue strain and possible breakage. If the trench is wide enough to allow proper back filling, it is also wide enough to work in comfortably. In the northern part of the United States the depth of the trench is generally regulated by the frost line, the cover being sufficient to insure against freezing. This cover is generally enough to properly cushion the pipe against excessive weight and the consequent strain.

Proper tools should be provided for the excavation work. In cases where it is necessary to go through paving or hard dirt surface, we have found that the cut can best be made with busters or spades operated by compressed air. The compressor is one of the handiest tools the water works man can have as it takes care of a great many hard jobs which are expensive to handle by hand. While it is better to have a compressor of at least 100 cu. ft. capacity, smaller ones may be purchased and mounted on a truck and driven from the drive shaft. The larger compressors should be purchased mounted, or mounted on the running gear of a second-hand truck and used as a trailer. To avoid undue jar to the compressor, the running gear should have good springs and at least solid tires if pneumatics are not available. All the tools in excavation work should be kept in good condition, and the spades and shovels should be of a light high-grade steel. The best shovels and spades are the cheapest in the long run and are not so tiring to the workmen due to their lightness.

The Trench.—The trench which is to receive the pipe should be graded with a string line the same as for sewer work making the high and low points come at hydrant locations, if possible. This will insure that the sediment can be blown out at the low points and the air taken out at the high points preventing the line from becoming air bound. If the walls of the trench being dug are dry and of the right material, no bracing will be necessary. However, sandy or wet material will require bracing in order to make the trench safe and allow the placing of the pipe. Water in the trench should be removed before attempting to place any pipe. Formerly this was taken care of by hand trench pumps, but the gasoline driven units are now so inexpensive that no pipe laying crew is complete without them. Clear water may be removed by motor driven centrifugals to good advantage. In laying out trenches it is a good plan to keep at least 5 ft. away from other parallel trenches, if possible, so avoiding the chance of the ditch on the side near the parallel trench caving in. Such cave-ins generally come without warning and are apt to be serious. Formerly when it was necessary to roll the pipe into the ditch, it was customary to pile all the dirt on one side of the trench. This sometimes created cave-ins because of the excessive weight of the dirt. Where the pipe is handled by derricks or cranes, it is not necessary to keep one side of the trench clear, but it is better to divide the dirt and thus spread the weight on both sides of the ditch. In the past it has generally been customary to dig the bell holes as the pipe was placed in the trench. However, where portable trucks are used are used it is possible to lay from 10 to 12 lengths per hour, so the bell holes cannot be dug after the pipe

is in the ditch without delaying the work. Under such conditions it is better to measure off the bell hole locations and put enough men digging bell holes so as to insure no delay in the pipe laying.

Laying the Pipe.—With the trench ready to receive the pipe, it is important that the laying proceed as fast as possible. With the portable truck derrick the pipe should be raised with the sling around the middle so as to keep it balanced. As soon as it is clear of the ground, the pipe should be given a final sounding to prevent defective or cracked pipe from entering the ditch. The derrick is then run alongside the ditch, the boom swung around and the pipe lowered. In the meantime one man should clean and dry the bell of the last pipe laid very thoroughly as many defective joints are caused by dirt or foreign matter. When the next pipe is lowered the same man should also clean the spigot end. He should then place a strand of hemp around the pipe and guide it into place when it is sent home. The best hemp to our notion is of the dry braided type, and two strands are usually sufficient. Should the pipe pinch to one side as it is being entered, it is easy to swing it from side to side or raise it with the derrick until the hemp is driven home and the spigot end properly centered in the bell.

In cases where it is impossible to use a derrick, the pipe may be lowered into the trench by means of a rope at ench end with a rolling hitch, one end of each rope being held under the feet of the men lowering, and the other end paid out as evenly as possible so as to lower the pipe without dropping. In this way two men can lower a length of pipe. For sizes too heavy for lowering by hand, a four legged derrick can be used, or even better a large crane or drag line.

Making the Joints.—After the spigot end of the pipe is home and yarned, the joint should be prepared immediately for the joint material as delay may cause foreign matter to enter. We believe it is best to use a square running rope with a clamp to tighten it up. We have also found it best to seal this running rope against leakage by the use of fire clay rather than ordinary clay. Fire clay may be used over and over again and is not expensive in the long run. After the running rope is sealed, a gate should be built up depending upon the materials used for joint purposes. Either lead or lead substitutes require heating, and while formerly the kettles were heated with a wood or coal fire, it is much better to use a kerosene burner as it will heat the material quickly and once heated will hold it in readiness for use, insuring against delays caused by cold material. The joint material should be handled carefully so as to avoid spilling and the possible injury to workmen. The pouring of the joint should be done continuously, and in case that one pot will not run the joint, additional pots should be in readiness to carry the pouring out with the least break in time. Immediately after the pouring of the lead, it should be caulked to take up the shrinkage caused by cooling. Formerly most of this work was done by hand, the caulker running around the pipe first with a chisel following up with the caulking irons using the small ones first. However, if compressed air is available, this method should be used in caulking. Compressed air driven joints are better than hand driven as the lead can be taken up from an eighth to a quarter-inch more than by the hand method without any danger of splitting the bells. Such joints are superior as the last one driven during the day is as good as the first, whereas the quality of hand caulked joints is liable to lag during the latter part of the day. Furthermore, where the pipe is being laid in large quantities it is absolutely necessary to caulk by air in order to keep up with the laying crew. Sometimes on the larger joints the lead fails to pour evenly causing a break in the joint, but this may be remedied by caulking lead wool into the spot where the break occurs.

Pouring Wet Joints.—At times unavoidable conditions cause the joints to become wet, and extreme care must be taken in pouring such joints. Before pouring the lead a quantity of coal oil should be poured into the joint, followed immediately by the lead. In place of the coal oil, lubricating oil or candle shavings may be used with equally good results. It is also a good plan to make a small hole with a knife in the bottom of the joint for drainage purposes. This may allow a little lead to run through, but it will soon freeze at the point of drainage and pour properly. When the pipe is finally placed in the ditch, it should not rest on any solid or unyielding projections, but should lay evenly so that it will not be subject to any strain as every strain is a potential trouble maker.

Cutting Pipe.—The writer has seen many cases of poor pipe cutting caused by awkward methods. A pipe can be cut fairly evenly if the work is done right. Before attempting to make a cut the pipe should be marked at the exact distance from the end by means of a tape or rule. It is then possible to place a running rope or even cloth tape around the pipe at this point, after which the whole circumference of the pipe may be marked very easily. A cross mark should be made to show the starting and ending points of each turn of the pipe. The pipe should then be placed on a heavy timber with the cutting line directly over the middle of this timber. Starting at the cross mark a slight cut should be made using a sledge and hardy. When the cross mark is reached the pipe should be rolled back to the point of beginning, after which a second and heavier line may be cut with the hardy. By rolling the pipe back and starting the cross mork each time, the strain will be kept equal. Finally the pipe will become crystallized to the point where it will snap off fairly evenly without projections exceeding a quarter of an inch. In making cuts on larger pipe it is a good idea to make the first round with a diamond point as this removes a considerable amount of the material. Then by following with the hardy, as above mentioned, the pipe will crystallize and crack. Cutting old pipe in the ditch has been more or less difficult, particularly in the large sizes. When the cut was made with regular cutters, the pipe was generally bound in place even after the cut at both ends was complete, making it necessary to break the pipe, which was oftentimes hard to do in the larger sizes. There is on the market at the present time an oxy-acetylene outfit having a special torch for burning castiron pipe, and we have found this to be the handiest method of cutting pipe in the ditch as the cut is at least a quarter of an inch wide, and the pipe is free as soon as the cuts are made. To secure the best results with such an outfit, the pipe should be drained as water in the pipe tends to carry away the heat. It is also best to make the first round with the diamond point as any chalk marks are burnt off by the hot flame, while the track made by the diamond point can be readily seen.

Valves. — Every distribution line should be properly valved. Most of us have had occasions when we would have given much to have had valves at the proper locations. These valves should be spaced so that a minimum amount of main is thrown out of service whenever it is necessary to work on the line. Not only is this according to the Underwriters' specifications, but it prevents the needless shutting off of house service. If the Underwriters' rules are followed, the system will always be properly valved. In setting valves a concrete base should be provided so that there is no chance of the valves settling. We have found concrete from old sidewalks to be ideal for this purpose. Every valve must necessarily be provided with a valve box or manhole so that shutoffs may be made quickly. The question of whether to use boxes or manholes is more or less optional in the small sizes, but valves larger than 12 in. should always have the manholes.

Hydrants.—Hydrants should be set at least not farther apart than each street intersection, and in the business district, or in the residence district where the intersecting streets are too far apart, additional hydrants should be set in the middle of the block. At least the business district should be equipped

with steamer hydrants, and it is better if the residential districts can also be equipped with the same although the necessity is not so great. In placing hydrants care should be taken that the hydrant is kept far enough back of the curb to clear all automobile bumpers, and it should be set high enough so that the fire department will experience no difficulty in making the hook-up by reason of dirt or snow being too close to the caps. The writer has seen many hydrants set at crazy angles and has made it a point that all hydrants set under his direction were properly plumbed. After plumbing the hydrant should be braced near the top with temporary wood braces to hold it plumb while the back filling material is being tamped in place. The hydrant should have a base of concrete similar to that used for valves, and it is most necessary that the space back of the hydrant to solid ground be filled with concrete to prevent the hydrant from blowing off. No wood should be allowed in these braces as it will rot and allow the hydrant to push away. At least a bushel or more of brickbats, preferably of soft brick, should be placed around the base of the hydrant to take care of the drainage water. If it is not provided, the hydrant will not drain with the probability of freezing. The writer has never set a hydrant without an auxiliary valve in front of it. The expense is not great and is justified as it allows the hydrant to be repaired without interference to service. Hydrant connections should be not less than 6 in. in diameter and the hydrant should preferably be of the same size.

Connecting New Lines.—Connecting new lines at right angles to old lines not provided with tees or crosses, naturally necessitates a tap which may be made in two ways, by means of a machine, or by cutting out a section of the pipe and setting in a tee or cross. When made by machine care should be taken that the split sleeve is centered evenly around the pipe and that there are no defects in the joint. The sleeve should be carefully leveled before the joint is run. After the tee is in place and the joint caulked, the machine should be hooked up and the cutting started. The pilot cut is easily made, but the main cut takes considerable labor, and it is of importance that the cutters be sharp and all ground to an even length otherwise the cutting will be uneven and exceedingly hard to make. After the cut is made and the piece drawn out, the valve should be closed and the machine removed, after which the laying of the pipe may proceed in the ordinary manner. In cases where it is necessary to insert a tee or cross, a section of the pipe should be taken out, after which the fitting may be set in place and the opening closed by means of a short length of pipe and a sleeve. Where the sleeve is placed a small section of the pipe is generally missing due to the fact that it had to be cut short in order to enter the bell. Should a valve be placed close to this point and the pressure applied to one side of the valve only, there is a possibility of the valve pushing toward this open space and opening up a joint at the valve. This space may be eliminated by cutting a very short section of pipe and dropping it in the opening before the sleeve is set.

Fittings such as tees, elbows and plugs must be properly braced against solid earth in a manner similar to the bracing required for a hydrant. If such bracing is not placed, the chances are that the pressure will open up a joint or crack a pipe near the fitting. Sometimes it is necessary to brace back a considerable distance, and we have found it very convenient to use old pipe between the fitting and solid earth in such cases.

Testing the Pipe Line.—At the completion of each block of pipe, a test should be applied to prove that no defective pipe or joints are in the line. Formerly when central station pressure was carried for fire service, it was necessary to make what you might term a high service test, but since the advent of the fire department pumper, the policy of putting on additional pressure has practically disappeared so that we feel safe in using domestic pressure for our tests. If possible test plugs should be provided so as to make it convenient for removing the air in the line and also for removing the plug when the test is completed. However, if test plugs are not available, an ordinary plug may be used with a lead joint shallower than normal. In cases where oxy-acetylene outfits are available, these joints may be melted very easily.

Back Filling.—Back filling may be done by machine, by hand back filler and team, or by hand, and the relative cost and speed is in the above order. Naturally a machine back filler is preferable although the use of a hand filler and team does not cost so very much more. Hand back filling is expensive and should not be practiced, if possible. We have found it best to pile all the dirt over the ditch, and after it is filled to flush the ditch. If this flushing is done from above, the results will be poor and incomplete as the dirt will wedge part way down in the trench, and the bottom of the ditch will not be properly settled. The best method of flushing is to place an 8-ft. pipe on the end of the hose and push this pipe into the ditch until it hits the water main. Then allow the water to flow until it shows up at the top of the ditch, after which the pipe may be moved forward about ten feet. This method is more efficient and better than hand tamping. We have taken a hand tamped ditch and applied the flushing in this manner and caused the dirt to settle several inches. Practically all the dirt that has been thrown out, except that displaced by the pipe, can be replaced in this manner.

Checking Costs.—The cost of laying a water main should be checked from day to day in order that everybody concerned is fully conversant with the results. The foreman on the job can practically make or break as regards costs. If he is in sympathy with the idea of economy and efficiency, and uses his head in planning his work and arranging his men, he can get good results at moderate costs.

Records.—With the job complete, a record should be made showing the length, depth, location of specials, hydrants, valves and any other data that might be of value in the future. This record should be placed on a map and filed away in a fire proof vault or safe. Card indexes should be made in duplicate showing location of all valves and hydrants, one set being kept in a fire proof place, and the other set kept convenient for instant inspection. Unless this is done, the project cannot be called complete.

Acknowledgment.—The foregoing is an abstract of a paper presented Oct. 4 at the meeting of the Missouri Valley Section of the American Water Works Association.

Union Announces New Water Meter

Union Water Meter Co., Worcester, Mass., is observing the 60th anniversary of its incorporation by announcing the new King Frost Protected Meter.

The King F. P. (frost protected) Meter is built to overcome every known weakness in frost meter design, the manufacturers claim. Among the new features built into the King F. P. are the position of the thrust roller, an eccentric which locks the disc chamber in place and the use of monel metal pins and lock screws which yield to excessive pressure such as frost.

The thrust roller is located on the outlet side of the disc slot, and is held in place by a monel metal pin which balances the weight perfectly and strengthens this edge of the disc, always heretofore the weakest point. Friction thrust is reduced to a minimum because the roller keeps the control in the center. The roller is made of hard rubber and this perfect insulation eliminates corrosion and galvanic action.

The new method of holding the disc chamber in place employs an eccentric which simplifies installation or removal of the chamber, and is said to eliminate any possibility of the chamber becoming bound. The intermediate gearing is assembled by the use of three slideable monel metal pins held in place on the side by a single lock screw. The same intermediate gearing is used on all sizes of meters and therefore is interchangeable. All bearings are oversize, insulated, adjustable and renewable.

New Traffic Rules for Boston, Mass.

Regulations Went into Effect Last Month

NEW traffic rules and regulations based largely upon the Boston McClintock traffic survey and in harmony with the National Uniform Traffic Ordinance, were placed in effect in Boston, Mass., on Oct. 8. An outline of the new regulations follows:

Parking Regulations. — Unrestricted parking streets are provided in the downtown district from ten o'clock in the morning for the remainder of the day: Both sides of Charles St., between Boylston St. and Beacon St.; and in Dorchester Ave. on the channel side between Congress St. and Fort Point channel drawbridge, and on the westerly side between the southerly end of the South Station and the drawbridge.

Unlimited parking has also been provided at Beacon St. on the Public Garden side between Charles St. and Arlington St. In all of the above cases the rule has been changed to require that all vehicles be backed to the curb at an angle of 45 deg. instead of at right angles as formerly provided.

Parking conditions on State St. in the center of the street between McKinley Sq. and Atlantic Ave. have been changed from 2-hour to all day parking.

The most important innovation in the new parking regulations is to be found in the provision of so-called "live parking" through the daylight hours on the Common side of Tremont St., between Winter St. and Boylston St. According to this regulation, only vehicles which are occupied by a licensed operator may be parked at this curb during the hours indicated. This rule is designed to render unnecessary the constant cruising of drivers of vehicles pending the pick-up of passengers in the shopping district. According to City Traffic Engineer John F. Hurley, it is believed that this regulation will substantially reduce the amount of traffic and turning movements on West and Tremont Sts., which in the past have been composed largely of cruising automobiles.

Special regulations are provided regarding the method of parking cars. Unless specially indicated by signs, vehicles are required to park parallel with the curb and with both right wheels within 1 ft. of the curb. In the congested district commercial vehicles are prohibited from backing to the curb for the discharging of merchandise except upon permit from the Board of Street Commissioners.

As a means of restraining all night parking, drivers are prohibited from parking vehicles for a period of more than one hour between the hours of one o'clock and seven o'clock in the morning. Pending the removal of the sidewalk on the Common side of Beacon St., from Charles St. to Joy St., parking has been prohibited on this street length.

Upon a considerable number of street lengths parking will be permitted in the new rules where it was formerly prohibited and in some cases prohibition will be placed where parking formerly was permitted. All of these changes will be noted by signs erected by the Police Department. The general one-hour parking rule applies in all of corporate Boston from 7 A. M. to 6 P. M. except on restricted streets. This means that there is no time limit on ordinary streets from 6 P. M. to 1 A. M. The restrictions on "no parking" streets are effective at all hours of the day.

Provisions Regarding Motor Vehicle Operation.—Under normal conditions, drivers of vehicles are prohibited from driving to the left of street cars proceding in the same direction. The only exception to this rule is when the roadway to the right of the street car is obstructed by construction work or similar obstacles. The rule does not apply to one-way streets.

Drivers are required to remove vehicles from street car tracks as soon as reasonable in order not to obstruct street car movement and are prohibited from crossing car tracks at street intersections when a street car has started to move through the intersection. Safety zones established at car stops by paint markings or by other signs are reserved for the exclusive use of pedestrians, and vehicles are prohibited from driving through the same at any time. A rigid restriction is provided prohibiting street cars or railway trains from blocking crossings during a period longer than five minutes.

Drivers are prohibited from backing vehicles around a corner or into an intersection. Fire apparatus responding to alarms must not be followed by drivers of private vehicles nor may they park within one block of fire apparatus which has stopped in answer to fire alarms. Special vehicles which are designed primarily for the purpose of advertising are prohibited from operating over the streets of downtown Boston.

Very specific provision has been included requiring vehicles to drive as closely as possible to the right-hand side or curb of the roadway. Drivers are prohibited from overtaking and passing other vehicles proceeding in the same direction within street intersections except when such intersections are controlled by traffic signals or police officers, nor within 50 ft. of an intersection if the overtaking movement requires driving upon the left side of the center of the roadway.

In order to make overtaking one vehicle by another less dangerous, operators are prohibited from changing their course of travel without ascertaining if such movement can be made with safety to other vehicles and then only when a suitable signal has been given by the operator.

Right and left turning movements are explicitly recommended in the new rules. Drivers desiring to turn to the left at an intersection must approach the intersection in the line of traffic nearest the center of the roadway. Drivers desiring to turn to the right at an intersection shall approach the intersection in the line of traffic nearest the right-hand side of the roadway. The regulations prohibiting left turns at specific intersections are similar to those which have been in force.

Drivers are prohibited from making complete turns at all street intersections which are controlled by signals or officers and are prohibited from turning around in any street unless the turn can be made without backing or causing delay to approaching vehicles.

All drivers of vehicles emerging from driveways or garages shall bring their vehicles to a complete stop before crossing the sidewalk.

Pedestrian Regulations. — The new regulations give the exclusive right-of-way to pedestrians crossing streets at intersections unless the corner is under the control of a traffic officer. In the latter case, while pedestrians are not prohibited from crossing against the signal, if they do so they must give the right-of-way to automobiles which are moving through the intersection on the go signal. Between street intersections pedestrians are not prohibited from crossing, but, when crossing, are required to grant the right-of-way to motor vehicles. A special restriction, however, has been placed upon drivers in such cases in the provision which requires the exercising of due care for the safety of pedestrians who might be in the roadway.

The pedestrian regulations do not specifically require pedestrian obedience at controlled intersections unless the officer in charge gives a specific command to pedestrians to stand on a sidewalk awaiting their turn. It is, therefore, not strict pedestrian control. It is in harmony with the provisions of the national uniform codes on this subject. The regulations are designed to give pedestrians crossing at proper places a more specific right-of-way than they formerly possessed. No changes have been made in the meaning of the red and amber signal combination. These will still indicate, at intersections in which they are used, the period when pedestrians have the exclusive right to use the intersection.

Street Sanitation Officials Hold Successful Convention

Papers Presented, New Officers, and List of Those Who Attended

ON October 8 and 9, at the King Edward Hotel, in Toronto, Can., the International Association of Street Sanitation Officials held their Ninth Annual Conference. Bigger and better than ever before, this convention brought together over 150 officials from the United States, Canada, and Cuba, who are interested in street sanitation. Highly interesting papers on all subjects of interest to the street official, worthwhile discussions, and beneficial inspection trips featured the two day convention, yet the feature of entertainment was not forgotten. A feature of the convention was the dinner and entertainment that had been arranged for Monday evening in the Pompeian Room at the hotel, in which room all the sessions were held. The afternoon of the second day was devoted to an inspection trip as guests of the city, after lunch at the Palais Royal.

Group of Officials Who Attended the Recent Toronto Meeting of the International Association of Street Sanitation Officials, October 8 and 9, 1928

Subjects Covered.—Among the interesting papers presented at the convention were one by Morris S. Jones, Deputy Commissioner of Public Works, Syracuse, N. Y., on methods of handling complaints. The effective and just method of dealing with disgruntled taxpayers used by his city proved interesting to the officials who heard his talk. Another highly interesting paper was one delivered by W. T. Knowlton, Sanitary Engineer, of Los Angeles, Calif. This well known engineer spoke on the maintenance of sewage collection systems. A third paper of great interest was that presented by W. J. Galligan, assistant superintendent, Bureau of Streets, Chicago. He told of effective methods that can be pursued to prevent the promiscuous dumping of rubbish. Like the two other papers mentioned above, this excellent contribution appears elsewhere in this issue. Other subjects discussed included garbage disposal, preventative street cleaning, the importance of street cleaning, the budget, snow removal, municipal parking grounds, collection service records, group insurance, vehicle tax for maintenance, street maintenance, airports, alley cleaning, convenience stations, and others similarly interesting.

New Officers.—New officers elected for the coming year are as follows:

President, Mr. Robert B. Brooks, Director of Streets and Sewers, St. Louis, Mo.

First Vice-President, Mr. L. W. Herzog, Commissioner of Public Works, Albany, N. Y.

Second Vice-President, Mr. Elmer C. Goodwin, Examining Engineer, Dept. of Street Cleaning, New York City.

Third Vice-President, Mr. A. J. Paul, Superintendent of Public Works, Ann Arbor, Mich.

Treasurer, Mr. P. J. Hurtgen, Director of Public Works, Kenosha, Wis.

Secretary, Mr. A. M. Anderson, 100 N. LaSalle St., Chicago, Ill.

Board of Governors:

1st District, C. A. Hillegas, Superintendent of Highways and Sewers, Pittsburgh, Pa.

2nd District, Carl Schneider, Aide to Commissioner of Public Property, New Orleans, La.

3rd District, W. J. Walsh, Assistant Engineer in Charge of Streets, Minneapolis, Minn.

4th District, F. J. Altvater, Commissioner of Highways, Denver, Colo.

5th District, W. C. Earle, City Engineer and Superintendent of Streets, Pasadena, Calif.

6th District, H. D. Bradley, Deputy Street Commissioner, Toronto, Ont., Can.

7th District, Lieut. Bernardo Wolf, Dept. Street Sanitation and Cleaning, Havana, Cuba.

Ex Officio Member Board of Governors (Past Presidents):

W. J. Galligan, Bureau of Streets, Chicago, Ill.

Theodore Eichhorn, Superintendent Dept. Streets and Public Improvements, Erie, Pa.

List of Registration

Abbott, Geo. B., Assistant, Motor Truck Sales Department, International Harvester Co., Chicago, Ill.

Anderson, A. M., Secretary, Chicago, Ill.

Aspinwall, J. W., District Manager, Marathon, N. Y.

Baker, M. N., New York City.

Ballantyne, Geo. H., Commissioner of Public Works, Syracuse, N. Y.

Bank, W. G., Assistant Engineer, Bureau of Street Cleaning, Newark, N. J.

Barnthouse, C. W., 322 Security Bank Bldg., Toledo, O.

Berry, R. B., Louisiana Road Machinery Co., New Orleans, La.

Bickle, R. S., Bickle Fire Engines, Ltd., Woodstock, Ont.

Bleck, H. B., City Engineer, Waukegan, Ill.

Boniface, A., Village Engineer, Scarsdale, N. Y.

Boylon, Fred E., Detroit, Mich.

Bradley, H. D., Deputy Street Commissioner, Toronto, Ont.

Brooks, Robert B., Director Streets and Sewers, St. Louis, Mo.

Buttenheim, E. J., American City, New York City.

Buckley, T. B., Superintendent of Garbage, Minneapolis, Minn.

Burnett, J. A., Toronto, Ont.

Campbell, S. M., Commissioner of Public Improvements, Owosso, Mich.

Carrigg, W. H., Superintendent Sanitation Department, Sioux City, Ia.

Conrath, W. G., Assistant Superintendent of Streets, Chicago, Ill.

Cook, A. B., Chief Sanitary Inspector, Charlotte, N. C.

Cronin, M. J., Commissioner of Public Works, Utica, N. Y.

Curran, John J., Superintendent Department of Streets and Public Improvements, New Brunswick, N. J.

Curry, Robert S., Captain Fire Department, Joliet, Ill.

Collins, E. O., Street Commissioner, Woodstock, Ont.

Crandall, B. L., Director of Research, The

Elgin Corporation, 501 Fifth Ave., New York City.
Deuschle, G. H., Superintendent of Streets, Kankakee, Ill.
Dies, George W., Street Commissioner, Toronto, Ont.
Dietrick, P. O., City Engineer, Niagara Falls, N. Y.
Dodd, Walter C., Superintendent, London, Ont.
Dodge, George C., 501 Fifth Ave., New York City.
Doran, J. E., Vice-President B. Nicoll & Company, Inc., New York City.
Earle, Ralph D., Jr., New York City.
Eichhorn, Theodore, Superintendent Department Streets and Public Improvements, Erie, Pa.
Engels, R. C., 164 Edgehill Road, Bala Cynwyd, Philadelphia, Pa.
England, C. F., Mussens, Ltd., Toronto, Ont.
Evans, R. C., Chief Engineer, Elgin Sweeper Co., Elgin, Ill.
Fife, Geo. W., 3142 College Ave., Indianapolis, Ind.
Fillion, E. E., 100 N. LaSalle St., Chicago, Ill.
Fitzgerald, Arthur E., Superintendent of Sewers, Binghamton, N. Y.
Fledderman, H. W., Superintendent of Street Cleaning, Louisville, Ky.
Flickinger, J. G., Assistant Superintendent Department Streets and Public Improvements, Erie, Pa.
Fogarty, J. P., Barber-Greene Company, Utica, N. Y.
Ford, Frank H., President Huntsville Fiber & Veneer Works, Huntsville, Ala.
Galligan, W. J., Assistant Superintendent of Streets, Chicago, Ill.
Garberg, James, Street Commissioner, 8th Ward, Minneapolis, Minn.
Gettelman, Fred, High Speed Snow Plows, Milwaukee, Wis.
Gibson, G. A., Motor Sales Department, International Harvester Co., Oak Park, Ill.
Giebenhain, F. E., Alderman 10th Ward, Minneapolis, Minn.
Gilliard, S. A., Buffalo, N. Y.
Gilmore, Earl C., Sales Manager, The Heil Co., Milawukee, Wis.
Gleason, J. V., Street Commissioner 3rd Ward, Minneapolis, Minn.
Goodwin, E. C., Examining Engineer, Department Street Cleaning, New York City.
Goss, I. M., Deputy Commissioner of Streets, South Bend, Ind.
Griggs, C. C., 100 N. LaSalle St., Chicago, Ill.
Grossart, Chas. A., Street Commissioner, Indianapolis, Ind.
Hamilton, Wm. J., Assistant Street Commissioner, Indianapolis, Ind.
Hannan, Wm., Jr., Nye Odorless Incinerator Co. of New York, New York City.
Harrop, Eli, Garfield, N. J.
Healey, Joseph, Member Board of Public Works, Evansville, Ind.
Henderson, T. S., Superintendent of Streets, Wilkes-Barre, Pa.
Herlong, Dr. M. B., City Commissioner, Jacksonville, Fla.
Herzog, L. W., Commissioner of Public Works, Albany, N. Y.
Hillegas, C. A., Superintendent Department of Highways and Sewers, Pittsburgh, Pa.
Hineline, E. S., Foreman Municipal Equipment, Milwaukee, Wis.
Howard, W. S., B. Nicoll & Company, Inc., New York City.
Hurtgen, P. J., Director of Public Works, Kenosha, Wis.
Hvass, C. T., Chas. Hvass & Company, Inc., New York City.
Jones, Morris S., Deputy Commissioner Public Works, Syracuse, N. Y.
Jones, L. H., Guelph, Can.
Keller, N. M., Commissioner of Streets and Public Improvements, Waukegan, Ill.
Klein, S. W., Clerk Board of Public Works, Evansville, Ind.
Koeling, O. C., Superintendent Municipal Equipment, Milwaukee, Wis.
LaDuska, Joseph, Superintendent of Streets, Binghamton, N. Y.
Lewis, John F., Director of Maintenance and Operation, Rochester, N. Y.
Luck, George C., Superintendent of Streets and Bridges, Oshkosh, Wis.
Luther, Lawrence, Assistant Street Commissioner, Freeport, L. I., N. Y.
MacDonald, R. F., Deputy Commissioner of Public Works, Fordson, Mich.
Maher, John T., Highway Parts Manufacturing Co., Elmira, N. Y.
Manning, Lawrence, 1225 Atlanta Trust Bldg., Atlanta, Ga.
Menter, C. J., Superintendent of Street Department, Waukegan, Ill.
Merricks, Homer I., Street Commissioner 9th Ward, Minneapolis, Minn.
Miller, Edwin A., Deputy Commissioner of Public Works, Rochester, N. Y.
Miller, John W., Superintendent of Public Safety, Clairton, Pa.
Moe, G. A., Cost Accountant, Minneapolis, Minn.
Monarch, J. W., Street Commissioner, Boise, Idaho.
Moss, Forrest, Secretary Board of Public Works, Louisville, Ky.
Moody, M. D., Masonic Temple Bldg., Jacksonville, Fla.
McGrath, Geo. E., Superintendent Bureau of Sewers, Chicago, Ill.
McHardy, R. H., Street Commissioner 13th Ward, Minneapolis, Minn.
McHugh, J. G., Pittsburgh, Pa.
McLaren, Capt. E. C., Grand Trunk Railway, Milwaukee, Wis.
McLenan, F., Binghamton, N. Y.
McNally, Edw. M., Havana, Cuba.
McPherson, C. D., Detroit, Mich.
Mudge, G. E., Service Director, Canton, O.
Nelson, J. W., Street Superintendent, Ottawa, Ont.
Nelson, N. P., President N. P. Nelson Iron Works, Inc., Passaic, N. J.
Nolan, M. J., Deputy Commissioner of Public Works, Yonkers, N. Y.
O'Day, Wm. L., Buffalo, N. Y.
Ohl, Vann E., Superintendent of Streets and Public Improvements, Clairton, Pa.
Olson, O. J., Street Commissioner 11th Ward, Minneapolis, Minn.
O'Rourke, Wm. S., Member Board of Works, Fort Wayne, Ind.
Osborn, I. S., Cleveland, O.
Ostvig, R. M., Street Commissioner 4th Ward, Minneapolis, Minn.
Owen, Mark B., Commissioner Public Works and Engineering, Fordson, Mich.
Paffrath, E., Assistant Sewer Commissioner, St. Louis, Mo.
Paul, A. J., Superintendent of Public Works, Ann Arbor, Mich.
Paulson, D. O., President Municipal Supply Co., South Bend, Ind.
Pitzele, Abe, Street Commissioner, East Chicago, Ind.
Place, Capt. Harrington, Engineer Detroit Bureau of Governmental Research, Detroit, Mich.
Raught, Frank T., Superintendent Ashes and Garbage, Binghamton, N. Y.
Raymond, N. I., City Engineer, Owosso, Mich.
Reardon, J. E., Assistant Director of Streets, Buffalo, N. Y.
Rerick, A. C., Vice-President Municipal Supply Co., South Bend, Ind.
Ricksecker, C., Superintendent of Streets, Beloit, Wis.
Rieger, H. A., Superintendent of Public Works Jackson, Mich.
Richl, W. H., City Engineer, Stratford, Ont.
Robertson, W. C., Wood Hydraulic Hoist & Body Co., New York City.
Rohm, P. Q., Assistant Superintendent of Streets, Chicago, Ill.
Schindler, C., Syracuse, N. Y.
Schlosser, A. D., Deputy Commissioner Public Works, Albany, N. Y.
Sharkey, J. H., Sales Manager Walter Snow Fighters, New York City.
Shafter, E. M., City Engineer, Royal Oak, Mich.
Shepley, Samuel E., Commissioner Department Streets and Public Improvements, Joliet, Ill.
Smith, C. T., Street Commissioner 10th Ward, Minneapolis, Minn.
Sneider, J. H., 131 Water St., Pittsburgh, Pa.
Snook, Thomas, Member Board of Works, Fort Wayne, Ind.
Stelzle, L. G., President Walter Snow Fighters, New York City.
Stilson, A. E., Engineer Morse Boulger Destructor Co., New York City.
Suitor, Roy B., Superintendent of Public Works, Niagara Falls, N. Y.
Tenjost, Wm. C., Director of Streets, Buffalo, N. Y.
Tew, A. S., Superintendent Collection and Disposal of Garbage, Mobile, Ala.
Thomas, A. J., Louisiana Road Machinery Co., New Orleans, La.
Thomas, H. W., Morse Boulger Destructor Co., New York City.
Thomas, Herbert, New York City.
Thompson, S. A., Foreman Asphalt Department, South Bend, Ind.
Thompson, W. I., 102 N. Bowne St., Jackson, Mich.
Tompson. W. R., Superintendent of Streets, Belmont, Mass.
Tracey, W. E., Brooklyn Ash Removal Co., Brooklyn, N. Y.
Tracy, James D., Superintendent Garbage Bureau, Erie, Pa.
Tredenick, J. E., Assistant Superintendent of Streets, Belmont, Mass.
Tyler, Wm. M., 501 Fifth Avenue, New York City.
Van Ettern, H. H., Treasurer, Hiler Engineering & Construction Company, Brooklyn, N. Y.
Van Frank, L. H., Chairman, Board of Public Works, Villa Park, Ill.
Vazquez, Benito Garcia, Chief Engineer, Department of Public Works, Havana, Cuba.
Walsh, W. J., Assistant Engineer in Charge of Streets, Minneapolis, Minn.
Weedon, I. R., Superintendent of Street Cleaning, Flint, Mich.
Wolcott, Harold E., City Engineer, Rockford, Ill.
Wolf, Lieut. Bernardo, Department of Street Sanitation and Cleaning, Havana, Cuba.
Worth, A. C., 465 Arlington Ave., Elgin, Ill.
Whitby, E. M., Roadways Engineer, Hamilton, Ont.
Zinn, B. C., Highway Trailer Company, Milwaukee, Wis.

Tractor Crane Handy For Laying Pipe

Frederic H. Poor, Inc., 50 Church St., New York City, manufacture a handy little tractor crane that is well adapted to such service as laying pipe, cleaning catch basins, handling shoring timbers, serving as a pile driver with a steam or air hammer on driving sheet piling, and for other duties requiring a portable outfit that can handle up to a maximum load of 2,400 lb., with the loads handled depending, of course, on direction of swing, and the horizontal reach.

This crane is mounted on a small tractor for the sake of moving under load and of portability, and derives its power from the power takeoff of the same tractor. Specially weighted wheels are used for the sake of counterbalance. The hoisting drum is directly connected to a self-locking worm gear; and is operated from the power takeoff through a clutch and bevel pinions by a control lever within easy reach of the driver. When the drum is not in motion the self-locking worm gear holds the load in suspension on the boom without the use of a friction brake.

The swinging boom is constructed of two steel channels firmly braced together, and equipped with the necessary sheaves and hook weight. The "bull wheel" by which the boom is swung about the mast is power driven by means of a chain and sprocket, and is equipped with an expanding brake of such design that the boom may be controlled in its swing, or, when not under power, be set in any fixed position. The lifting capacity is greatest with the boom swung forward. Adjustable telescoping outriggers may be supplied to permit the lifting of greater loads.

Special Traffic Police at School Crossings.—Toledo, O., is employing special policemen for traffic work at school crossings. The employment of 20 men at a lower rate of wages will release a similar number of men for other important work requiring more thorough training and experience.

640 Municipalities Have Zoning Ordinances.—On Sept. 1 the total number of cities and towns in this country known to have zoning ordinances in effect was 640.

Municipal News and Water Works

Vol. LXXV DECEMBER, 1928 No. 6

The Absurdity of Making a Political Issue of Water Power

In the recent presidential campaign Gov. Smith tried to introduce as an issue the government ownership of water power. In bolting the Republican party Senator Norris cited Gov. Smith's stand on this matter as the main reasons for his action. He said:

"For his courageous stand on this, the most important issue now confronting the American people, he (Smith) is entitled to the warmest praise and commendation, regardless of politics or of party.

"The importance of the question transcends any party consideration. Never before in the history of our country has there been such a startling disclosure of a mammoth attack at the very foundation cornerstone that supports our government fabric. Never in history has there been anything that will compare with it and regardless of politics, regardless of everything else involved in this campaign, it seems to me the people of the country must rise in defense of our liberties, in defense of our common country, and they must do it soon before we are helpless within the clutches and the control of this giant monopoly."

Although Gov. Smith advocated government ownership only of waterpower plants, it is evident that Senator Norris thought Gov. Smith included all power plants, for his denunciation of the "power monopoly" and praise of Smith can mean nothing else.

Senator Norris, like Gov. Smith, is clearly misinformed as to the value of water rights, and he is equally mistaken as to America's "helplessness within the clutches and control of this giant monopoly." Had he consulted any engineer broadly experienced in the cost of generating electric power, he would have learned that hydro-electric power has ceased to be a serious competitor of steam-electric power. Had he talked with any State Public Service Commissioner he would have learned that the "helplessness" in the clutches of power monopolies is not a fact, never has been a fact, and is, less than ever, likely to become one. Nearly every state has such a commission that controls the rates charged for electric current. So where is the alleged "helplessness" of the American public? Senator Norris talks a language about utility "trusts" that is ancient history. And it is equally ancient to speak of water power as a thing of relatively great value.

Large modern steam-electric plants are generating electricity with less than one pound of coal per kilowatt-hour. With coal at $5 a ton (of 14,000 B. T. U. coal) this means that the fuel cost is less than one-quarter cent per kilowatt-hour, or about one-fifth cent per horsepower-hour. The labor of operating such plants costs about ten per cent of the cost of the coal, bringing the cost of fuel and labor to about 0.28 ct. per K. W. H. (kilowatt-hour). Such a plant costs about $120 per kilowatt (or one and one-third horsepower), and usually operates on a load factor of about 50 per cent; but since standby equipment equal to about 25 per cent of the peak load is usually provided, to take care of repair layoffs and growth in the load, the investment is about $150 for every 4,400 K. W. H. generated annually. With a fair return rate of 8 per cent on the investment and a depreciation rate of 4 per cent, the annual cost of these fixed charges is 12 per cent of $150, or $18, which, divided by 4,400, is 0.41 ct. per K. W. H. The annual maintenance cost on such a plant may be taken at 2 per cent, which amounts to 0.07 ct. per K. W. H. Taxes seldom exceed half the maintenance in cost. Summing up we have:

	Cts. Per K. W.H.
Fuel (1 lb. per K. W. H. at $5 a ton)	0.25
Labor	0.03
Maintenance (2%)	0.07
Depreciation (4%)	0.14
Taxes (1%)	0.04
Fair return (8%)	0.27
Total	0.80

This total cost of 8 mills per kilowatt-hour is what many large steam plants are now attaining, and it is less than the fixed charges alone on the average hydro-electric power plant and its transmission line that delivers the power. Hydro-electric plants usually cost more than three times as much as steam plants of equal capacity, when the transmission lines that bring the current to the city are included, as they must be included if comparisons are to be made. Even if the hydro-electric plant had no standby capacity at all, and if it cost only 2.5 times $120 per K. W., the investment would be $300 per K.W. Then if it were assumed to have no depreciation and no operating expense other than taxes, its fixed charges of 8 per cent fair return and taxes of 1 per cent would be $27 a year, or 0.6 ct. per K. W. H. at a 50 per cent load factor.

But to assume that such a plant does not depreciate is an economic error of the first magnitude, for every invention that lowers the cost of producing power by steam lowers the value of every hydro-electric property in America. At first such a lowering of value merely decreases the value of the water rights, but where there ceases to be a water-right value (as occurs when power is generated by steam as cheaply as by water power), then the value of the hydro-electric plant begins to decrease as a result of decreasing cost of steam-generated power. In short, it is a fatal economic blunder not to estimate functional depreciation in every hydro-electric plant. The editor's experience, which has been rather broad in these matters, leads him to estimate not less than 2 per cent annual depreciation in a hydro-electric plant. This is equivalent to $6 a year per K. W. on a $300 cost, or about 0.14 ct. per K. W. H. with a 50 per cent load factor where there is no standby capacity. This makes a total of 0.74 ct. per K. W. H. for fixed charges and taxes alone, on a plant devoid of standby capacity. When operating expenses, including maintenance, are added, the total exceeds the cost of steam-generated power.

Rare indeed is the new hydro-electric project that can be built today in America for $300 per K. W., including

transmisison line. Rarer still is the project that calls for no steam standby to furnish power when the water supply of the hydro-electric plant is inadequate.

The steam engine is still susceptible of a considerable increase in efficiency, whereas hydro-electric plant efficiency has almost reached its limit. By the use of lower-priced fuels steam plants are steadily decreasing the cost of generating power, whereas hydro plants have no similar prospect of improvement. The construction cost per kilowatt of steam plants has declined much more rapidly than that of hydro-electric plants, and there is no prospect of any change in this respect.

All in all, it is very clear that new hydro-electric developments in America will grow progressively fewer and less in relative importance. Our Gov. Smiths, Ex-Gov. Pinchots, and Senator Norrises may continue for a while to beat the alarm drums, but the tumult and the shouting will soon die as "the captains and the kings depart."

Is America "Beyond the Reach of Rivalry"?

The London Morning Post, in commenting on the Rockefeller gift of a library to Cambridge University, said: "The Rockefeller Foundation hands out millions as others give their thousands; and if such vast wealth is rare, such willingness, and even determination, to bestow that wealth for impersonal and unselfish uses is hardly less rare. In that respect, America has set an example to the world—has, indeed, almost created a tradition, in which her vast resources place her beyond the reach of rivalry."

To these last dozen words we call attention. In them is the commonest European explanation of American prosperity. Yet Russia has natural resources as great as ours—vast areas of fertile soil, hills of coal and iron ore, petroleum in huge quantities and great supplies of the basic products that are to be found in these United States. But there are no Russian Rockefellers. Nor is there a prosperity comparable, even remotely, with that of England. Natural resources, therefore, do not supply a sufficient reason for American world supremacy in wealth and in income.

Universal education, "mass production," and half a score of other reasons for American success are often mentioned. Rarely is mention made of the one thing that distinguishes America most from other countries, namely industrial freedom. Yet it is perhaps the most obvious difference between America and Russia. Whereas Russians are now fettered by a system worse than any tzar ever imposed, Americans enjoy more freedom to initiate and carry on business enterprises than is to be found elsewhere.

Freedom alone does not lead to prosperity, but it is one of the essential conditions of great prosperity. Freedom from labor-union restrictions, freedom from social restrictions (such as caste), freedom from religious restrictions, freedom from laws that thwart initiative, freedom from unwise tariffs and other laws that hamper business, freedom from heavy taxation for huge standing armies or navies, freedom from socialistic "doles" and "pensions"—such are the sorts of freedom that Americans enjoy to a greater extent than any other nation.

As we write, one of the leading political parties in England is proposing an old-age pension for every one who has reached sixty-five. Unemployment and sickness "doles" are to be increased. Maternity "doles" already exist. Instead of encouraging thrift and individual initiative, laws are enacted that reward the thriftless and penalize the thrifty. All this is done in the name of justice and charity. But it is a forced charity, and the justice of it is certainly not the sort of justice that is pictured in the parable of the faithful servant.

Why States Should Build Pavements Through Towns

Bottle-neck streets and poor pavements characterize many of the main thoroughfares of cities and towns. A fine, modern state highway often enters a city only to be greeted at the very threshold by a bumpy, beggarly roadway. When the reason for such a greeting is sought, it usually is that the abutting property owners have refused to be assessed for widening and properly paving the street. Nor can you always blame them, for why should they be asked to stand the entire cost of an improvement that is far in excess of their own personal needs? With almost equal justice might a farmer be required to pay the entire cost of a four-track railway through his farm.

This being the condition that confronts us in almost every town, we should set about finding a remedy that will promptly change the condition. For many years we have editorially advocated one remedy, namely, that the city at large pay most of the cost of improving all streets that serve as highways for through traffic. But there are some 10,000 incorporated towns and cities in America, and many officials and voters in each that must first be persuaded to change present assessment practices before this problem can be solved along the lines that we have hitherto advocated. Consideration of the magnitude of this inertia leads us to change our solution of the problem.

Wherever a state highway system exists, let the state build and maintain that part of it that extends through a city or town.

It should not be difficult to secure amendment of laws so as to enable a state to extend its highways through cities and towns, whereas it seems to be impracticable to get cities and towns to amend their street assessment ordinances. Much the same sort of difficulty faces us here as faced the early advocates of better country roads. When the cost of roadwork was entirely borne by the farmers, ours was a country of mud or dust highways. The state-aid plan has largely altered that condition. We advocate the universal extension of that same plan to city and town streets that are arteries of through traffic.

The congestion on many such streets is so bad that traffic is greatly impeded. Even worse, perhaps, are the deaths and maimings that exist where bottle-neck streets cause road-hogging to display itself in its most aggravated form. But there is little need of complaining about a condition that excites complaints from every one. The real need is to diagnose the cause of the disease and to apply the remedy.

H. P. Gillette

Portable Asphalt Plant Does Resurfacing Job

Methods and Costs at El Paso, Tex.

ONE of the never ending things that comes hand in hand with construction is maintenance. In fact, economic equations do not consider original construction cost as an item in the equation. But try and find one that omits maintenance as an item.

Since this problem continually confronted the city of El Paso, Texas, they recognized that it would be more economical for them to resurface some of their rough streets than to reconstruct. They used methods a little out of the ordinary and the city engineer states that they were surprised with the results obtained.

The city owns and uses a Chausse portable hot patch machine for their resurfacing and patch work in conjunction with a home-made hand roller weighing 1,250 lb. This last is somewhat at variance with standard practice, but the city engineer claims to be getting satisfactory results. They use an asphalt of 50-60 penetration and get a thorough mixing from the machine.

The cost data which follow refer to patch work and resurfacing. The resurfacing, as given in these figures, would probably average 1 in. thick. It was laid on a black top thoroughfare street that had become extremely wavy. The surface of the old pavement was thoroughly cleaned, then sprinkled with hot asphalt and the resurfacing mixture applied. Where it was necessary to feather-edge the surface, it is staying put and in place.

The portable mixing machine is a complete small asphalt plant. It dries and heats all material, measures all ingredients, mixes in desired proportion and delivers the hot stuff right handy to the job. The material passes through the rotating sand drier to the measuring devices and then into the pugmixer, where it is mixed with the hot asphalt.

Fig. 2—Showing Results Obtained in the Resurfacing Work

PATCHWORK COSTS
Typical Month

Foreman	$ 150.00
Laborers (6) and watchman	442.50
Asphalt, 20 bbl. at $6.30 (California grade "D")	126.00
Kerosene, 382 gal. at $0.14	53.48
Crushed stone, undersize of ¼-in. screen at $0.50 ton f. o. b. quarry, 73.7 tons	36.85
Sand, 8 cu. yd. at $1.50, delivered	12.00
Gasoline, 144 gal. at $0.14	20.96
Oil, 9¾ gal. at $1.00	9.75
Blacksmith work	17.50
Miscellaneous (lanterns, waste, etc.)	8.95
Depreciation, 25 days at $5.00	125.00
Cost for month	$1,011.99

During the month 762.2 sq. yd. of patchwork was laid which cost $1.327 per square yard. This does not include overhead.

RESURFACING COSTS
Typical Month

Foreman	$ 150.00
Laborers (7) and watchman	474.00
Asphalt, 47 bbl. at $6.30 (California grade "D")	296.10
Kerosene, 519 gal. at $0.12	62.28
Crushed stone, undersize of ¼-in. screen at $0.50 f. o. b. quarry, 135.25 tons	67.63
Sand, 15½ cu. yd. at $1.50, delivered	23.25
Gasoline, 316 gal. at $0.14	12.64
Oil, 14¼ gal. at $1.00	14.25
Blacksmith work	0.35
Miscellaneous (brooms, lanterns, etc.)	14.82
Depreciation, 27 days at $5.00	135.00
Cost for month	$1,250 32

During the month 3,443.8 sq. yd. of resurfacing was laid at a cost of $0.363 per square yard. Overhead is not included.

Fig. 1—Showing Condition of Street Before Resurfacing

Re-Mapping American Cities.—Rapid progress in mapping the cities of the United States according to the economic rather than their political boundaries as a basis for the 1930 census is reported by the Civic Development Department of the Chamber of Commerce of the United States. Of 144 cities of 50,000 and over in the country, 26 are at work preparing the new maps of their metropolitan districts and 27 have already completed their maps. A number of others are preparing to take up the work of tracing the limits of the economic activities centering upon them. From this it appears that more than half the cities of the required size are drawn upon this new scale.

A Municipal Employment Standard

Code for Employees of Berkeley, Calif.

A code of standards for the information of employees of the city of Berkeley, Calif., has been prepared recently by John N. Edy, City Manager. This code, which is distributed in printed form to every new employee of the city, contains so much of interest to municipal employees generally that we are reprinting it below.

In accepting a position in the municipal service of Berkeley, you will want to know these facts:

No Politics.—The service is not conducted along "political" lines and employes are not subject to, nor may they rely upon, political influence. Persons seeking an opportunity to gratify political aspirations or to capitalize public acquaintanceship for political reasons are not eligible for emploment in the administrative service. This is a measure of protection for you as well as for the public.

Employes may not bring with them into the service any prejudice for or against people or organizations that might affect the cordiality of their contacts with other employes or with the public. Regardless of your position in the service, it is essential that you cooperate cheerfully with all your associates and that you serve all of the public and its several groups with equal interest and loyalty.

Employes are not under so-called civil service, although employments and promotions are predicated upon the merit system. The plan of personnel administration in effect is deemed fair to the public and to the employe; but the final responsibility of the city manager in personnel matters as provided in the charter cannot be delegated or relinquished. One who feels the need of special "protection" in his position should not join the service.

Ability the Test.—People enter and remain in the municipal service exactly as they serve private business: that is, on the basis of the employer's (the city's) need and the employe's character, ability and willingness to give cheerful, competent service under the conditions laid down by the employer (the city). The public does not owe you or me a place on its payroll. If your work or working conditions or associations become distasteful, it is your privilege to discuss the fact frankly with the head of your department or with the city manager, beyond that, and failing an adjustment that satisfies you, your only recourse is to seek other employment, exactly as would be the case if you were working for a private employer.

Opportunity for Advancement.—The position to which you aspire and the work you will do are significant parts of the service. No matter what your duties are, have pride in them; also, maintain your sense of proportion. Yours is but one of many positions, all of them important; your department is but one of several, all of them essential. Loyalty to your colleagues and to your particular branch of the service should but intensify your loyalty to the organization as a whole. There is but one administrative service.

Few persons enter the service in every respect qualified and trained for their special duties; all of us have much to learn. Upon the foundation of your past experience and training it is expected that you will build toward the objective of maximum personal accomplishment. Your future in the service depends upon the extent and success of your efforts to improve yourself and to increase your ability. You may assume that you will never be "too good" for the service; and you may aspire to any position, including department headships and the city managership.

Best Efforts Expected.—The department head under whom you will be employed is engaged to direct the activities of the department and to assume responsibility for its accomplishment. He is a person of character and an expert in his field. You may give him your respect and confidence and loyalty because he is big enough in experience and ability to deserve it. He will expect from you the most conscientious and acceptable effort because he can accomplish his program only with competent and industrious people. His instructions and suggestions will serve as an adequate guide in the performance of your duties. His aid and counsel and that of other depatrment heads and the city manager are available to you in time of personal stress.

You will find that the service is composed of serious-minded men and women aspiring to the attainment of an ideal. This ideal is not a vague, indefinite thing, conceived solely as an object of sentimental regard or framed to trick the public into a false feeling of confidence. On the contrary, it is an intensely practical, workable and attainable ideal, expressed briefly as follows:

The Goal.—The municipal service of Berkeley shall be efficient, business-like, helpful and courteous; and the persons employed to render this service—all of them—shall exemplify these characteristics.

The above will bear re-reading; it is the goal toward which your efforts must lead.

The city does not expect to control your off-duty conduct, but you should remember this: the successful performance of your duties requires that you be at times physically fit and mentally alert. This means fair treatment of your body and mind while off duty. Moreover, because you are part of the municipal government, people will attach special significance to what you say regarding it. Your conduct and your comment will always be interpreted by the public as reflecting the standards or policies of the service, of the head of your department, the city manager and the council. You can never act or speak "unofficially."

Prospective employes often ask what advantages or inducements are offered by the municipal service of Berkeley. As I view it, the answer is quite obvious:

Inducements of City Work.—First—The opportunity to do something that contributes to the totality of comfort and convenience and happiness of some eighty thousand people. That is decidedly worth while.

Second—Remuneration that represents, as nearly as we can determine it, an honest valuation of the individual service, with due regard for the law of supply and demand. That is fair to both parties.

Third—Assurance that within the limitation of appropriations and the program of municipal activities, continuance and upward progress in the service depend solely upon the employe and his ability to grasp the opportunities offered him. No other vocation can do more.

And, Finally—the privilege of working with people who are clean and competent; people whose ideals and aspirations and emotions are similar to yours; people you can respect and like and enjoy. And that is a rare privilege.

Life is not easy. For most of us, there is no material reward without hard work. The municipal service is exacting; but it is an honorable service, worthy of your best efforts and your fullest faith. If you doubt that, don't sign up. If you believe it—and I believe it—you'll get a lot of joy out of the new job.

Kentucky-Tennessee Water Works Men to Meet.—The next annual meeting of the Kentucky-Tennessee Section of the American Water Works Association will be held Jan. 24, 25 and 26, at Chattanooga, Tenn. Mr. F. C. Dugan, Kentucky State Board of Health, 532 W. Main St., Louisville, Ky., is secretary. Knoxville, Tenn., was originally selected as the meeting place, but change has been made to Chattanooga, Tenn.

Maintenance and Operation of Water Distribution

Uniform Service—Operating Cost—The Trouble Wagon—Fire Hydrants

By W. H. HENBY

President, St. Louis County Water Co., University City, St. Louis, Mo.

THE maintenance, and largely the operation, of a water distribution system, depends to a great extent upon the design and construction. A poor design, however well built, will be costly in maintenance and operation; and a good design poorly constructed may be equally costly to maintain and operate.

It is almost axiomatic that the faults of construction of a good design are less costly to repair or replace than are the evils of a poor design, however perfect the construction.

The ideals sought in maintenance and operation may be considered as follows:

(1) Uniform service.

(2) Comparatively low cost of operation.

(3) Reasonable investment charges.

Uniform Service.—Good service is uniform not only from day to day for the same consumer, but as between consumers in different parts of the distribution system, and it is here that design plays an important part in operation.

To insure service to the consumer who gets water through a long mileage of water pipe, or at a higher elevation, the size of the pipe must be such that the friction-loss will not deprive him of water at times of maximum consumption, or means must be provided for storage in his vicinity to be drawn upon when consumption exceeds the carrying power of the supply mains to deliver at a given minimum pressure. Stand towers or elevated tanks are a useful part of design under these conditions.

To maintain an even pressure in a locality demanding a peak supply at certain more or less irregular intervals, is one of the almost impossible tasks imposed on waterworks operators, and is one that must be worked out in each case as a separate and distinct problem.

Peak loads which come from unusual consumption for filling pools or irregular manufacturing purposes may be provided for by insisting that proper rules for the unusual service be observed.

The peak load due to sprinkling lawns and gardens is more easily prognosticated in point of time, but in a suburban community may amount to several times the usual and regular consumption, so that meeting it with a uniform pressure is almost impossible without having the plant greatly overbuilt.

Uniformity of Appearance of Water.—It is not always possible to get a polished water without a sand filter. If the water is filtered there should be no trouble at all in getting clear, sparkling water at all times, but not all supplies demand filtration. It is this supply that is good enough to make it possible to save the cost of installing filters and filtering that is hard to keep uniform in appearance. Each problem is a separate problem in itself and must be worked out by itself.

Comparatively Low Cost of Operation.—I say "comparatively low cost" because it is always possible to cut cost of operations by lowering the quality of service; and though it is always desirable to lower cost of operation, it is never justifiable to cut costs to the extent that service is impaired.

Operating Costs consist of:

Production cost.

Distribution cost.

General overhead.

Production expense does not concern us in this connection, but the price and manner of distribution is important.

To begin with, the tap on the main which is usually the first contact of the new consumer with the water company. Most water consumers know nothing of the size of tap required and their first reaction to the information that taps on water mains are of various sizes is usually that they want the largest size, assuming that the larger the tap the better service irrespective of other conditions.

For a small house the size of the tap is not of paramount interest, but in the case of a truck gardener who takes only a very small amount of water during eleven months in the year, and wants an almost unlimited supply at the time that other consumers are using a peak load supply, the size of the tap on the main is important, since a few peak load consumers given capacity to draw any quantity of water from the mains may deprive other regular users in the locality of their usual supply, reduce pressure needed for protection from fire, and through sudden and unusual rate of flow through the mains, cause sediment or deposit in the mains to be stirred up.

The size of the tap granted to the consumer should be proportioned to his needs with consideration to the needs of other consumers. A careful, painstaking and complete explanation of the size of the tap sold will often in the beginning of the consumer's relation to the water company make of him a friend to the company, who will cooperate in the future.

The customer signs an application for water service, or a contract for supply, of the nature of which he is usually ignorant and of which he really at that time doesn't care to be informed. An explanation of the scale of rates is worth while and may often save expensive inspections and explanations later. Failing to get the consumer's interest in the rates, it is well to induce him to take away with him a copy of the application he has signed.

After the residence is completed and the consumer is occupying the premises, the first water bill is apt to justify careful attention. In the first bill at a new home there is all too often the cost of water wasted through new plumbing, that on account of lack of proper adjustment leaks badly, and the cost of constant watering of a newly sodded lawn, and the unusually large quantity of water used in cleaning and shaping up after the contractors. The bill is large—larger than future bills are apt to be, and here again the cost of inspecting plumbing without charge and advising about consumption with the consumer is a justified part of the cost of distribution.

When the new consumer has received and paid his first bill to the company and feels that the company is interested in his account, he is in a fair way to remain a satisfied consumer.

The Trouble Wagon.—This much-maligned part of the equipment of every distribution system is a cross that must be borne by every management. It may consist of the overtime of a hard-worked, general utility man, or the superintendent, who may find after he has been on duty for twelve hours, he is the trouble wagon for twelve more hours in the same day. If the plant is larger, several gangs with trucks may be the day shift, with one well equipped gang for night duty. I've never found a night gang to be too well equipped.

The trouble wagon appears on the payroll with great regularity, but pays no dividends in money, and money is the unit that stockholders and auditors use in measuring successful operation. The manager who fears the evils of mounting costs and tries to economize by cutting down on this part of his work is apt to find himself in worse stead.

The duties of the trouble wagon consist of meeting the unusual—the unlooked for—the unexpected demand for repairs that cannot wait for the regular order of operations—as a break in a water main, or failure of a fire hydrant to function properly during a fire, often caused by fire fighters endeavor-

ing to open a standard fire hydrant by turning to the right; and the complaint of consumers of muddy water, of lack of pressure, of over-registration of meters, of noisy meters, of incivility of employees, etc. Many of these complaints are trivial and inconsequential, but they must be met and answered and the proper inspection and answering is a material part of operating expense.

All of the complaints are not trivial by any means, and the company that fails to investigate all reports is in a fair way to get into serious trouble by neglecting them.

Fire Hydrant Maintenance.—The function of fire hydrants is to provide a means for fighting fires. A fire may be reported in any part of the area at any time of the day or night, and unless there is a proper water supply with proper pressure in all of the mains, and all of the hydrants are in proper operating condition all of the time, the service is apt to fail.

To make it possible to give the hydrants proper attention without inconveniencing water consumers by shutting down mains, we put a gate valve on every fire hydrant lead.

All hydrants are flushed, packed, oiled, painted and are not passed as properly inspected until they are found to be draining properly, in October and in the first part of November of each year. After this general inspection, of which a record is kept of the work done on each hydrant, the section foremen are made responsible for the hydrants in their respective districts, and look out for evidence of tampering with the hydrants, which may result in their being out of commission when needed. Unauthorized persons sometimes open the hydrants with Stillson wrenches to get water for various purposes and sometimes damage the hydrants. In a large distribution system, some of which is sparsely occupied, the water company cannot effectually police all its hydrants all the time, so a constant alertness to detect and repair possible damage is required.

After the general inspection in the fall just before freezing weather begins, the next general inspection comes with the breaking up of the frost in early spring, in which inspection the condition of each hydrant is recorded.

Most dangerous fires occur at night. To aid the firemen in locating hydrants when they are not near a street lamp, we have adopted the uniform practice of painting the top or cap of the hydrant with aluminum paint, which will reflect any light there may be and makes the hydrant easy to find. The body of the hydrant is painted black to make it as inconspicuous as possible.

The location, spacing, operation and maintenance of gate valves is a fruitful theme for discussion, but not now.

Acknowledgment.—The above is a paper presented Nov. 16 at the Missouri Conference on Water Purification.

Combined Water Tank and Lookout

Wentz Camp, which is located four miles northeast of Ponca City, Okla., is one of the best equipped boy scout camps in the country. It comprises 160 acres on which barracks have been erected and improvements made to accommodate a maximum of 1,000 boys.

The camp is open the year 'round,

Combined Water Tank and Tower at Wentz Camp

but the chief activities will take place during the summer months, when groups of boys from Oklahoma and neighboring states will stay for periods of three weeks each. Construction and management is in charge of a staff headed by Roy W. Williams.

One of the first things the visitor sees as he approaches the camp is the combined water tank and lookout. It is an interesting structure shaped something like a giant scepter. The spherical portion is 21 ft. in diameter and holds 30,000 gal. of water, which is used as a general supply for the camp. The tower or cylindrical portion is 7 ft. in diameter and 75 ft. high. It encloses a circular stairway which extends through the tank to a platform or lookout 10 ft. 6 in. in diameter. This observation point, which is 94 ft. above the ground, is surrounded by a lattice fence and equipped with a telescope and searchlights.

The steel plates used in building this structure range from $\frac{5}{16}$-in. to $\frac{5}{8}$-in. in thickness. They were fabricated at the Western plant of the Chicago Bridge & Iron Works and erected by one of that company's field crews.

A swimming pool and additional buildings are under construction at the present time.

Traffic Waste

As a measure of the possibilities of saving money through modern traffic regulation and control, A. B. Barber, Director of the National Conference on Street and Highway Safety and Manager of the Transportation Department of the Chamber of the United States, points to the enormous losses due to traffic congestion.

"Aside from the human factor," he says, "cities using modern traffic methods are receiving a direct dollars and cents return.

"A survey of traffic delays in downtown Boston showed that they cost the community $24,500,000 a year, in addition to losses from accidents amounting to more than $2,000,000 a year. Chicago's cost of traffic congestion has been estimated to be in excess of $600,000 a day and New York's more than $1,000,000 a day. The nation's bill for traffic delays is conservatively placed at $2,000,000,000 a year.

"There is another side to the picture. San Francisco found that its new traffic code resulted in reductions of accidents ranging from 30 to 40 per cent in the records of companies operating 50, 100 and 400 motor vehicles. One street railway company reported a reduction of 24.7 per cent in pedestrian accidents. A saving of $2,000,000 a year in the cost of automobile accidents is being made for San Francisco motorists. Los Angeles reports an increase of 30 per cent in the movement of street traffic after revising its regulations."

New Journal for Sewage Field

The Federation of Sewage Works Associations published the first issue of Sewage Works Journal during October. This is a "quarterly journal devoted to the advancement of fundamental and practical knowledge concerning the nature, collection, treatment, and disposal of sewage and industrial wastes, and the design, construction, operation, and management of sewage works." It is published at the Association's headquarters, 20th and Northampton Sts., Easton, Pa. The Journal is edited by Dr. F. W. Mohlman, chief chemist, The Sanitary District of Chicago, 845 South Wabash Avenue, Chicago, Ill. William F. Buffum, general manager, The Chemical Foundation, 85 Beaver St., New York City, is business manager. The Journal has a page size of 6⅞ by 9⅞ in. and a type page of 4½ by 7⅜ in.

Oderless Operation of a 2-Story Sewage Treatment Plant

How Conditions at Plant City, Fla., Were Remedied

By CHARLES CARROLL BROWN
Associate Editor, Municipal News and Water Works

VISITS during the past two years to some 50 medium and small sized sewage treatment plants have shown that practically none of them are operated without odor and most of them are either (1) entirely neglected; (2) operated by incompetent men; (3) badly designed; (4) subject to some special local conditions not properly understood; or (5) subject to the common condition of frost and cold for a part of the year, the consequences of which cannot be or at least are not entirely overcome during that part of the year which is favorable to odorless operation. The nuisance created by the three first mentioned conditions is in some cases so slight or the plant is so far removed from habitations that it is neglected or is tolerated rather than spend the money required to remove it entirely. Climatic conditions are of paramount importance but may be overcome in large measure by proper operation and expenditure of enough money. It is inexcusable, except on the ground of ignorance, to permit nuisance from sewage treatment plants where climatic conditions are favorable. This article describes the operation of a plant under such favorable climatic conditions after some defects in its original design were corrected, although the design as a whole is not in conformity with the best practice.

The Situation at Plant City.—The writer was asked by the city manager of Plant City, Fla., to devise some method of operating two small circular 2-story sewage treatment plants which were producing nuisance during much of the year, some in the plant itself but more in the ditches into which the effluents were discharged. During the rainy season of the summer this nuisance is reduced to a minimum owing to the washing out of the accumulations in the ditches and the dilution of the effluent from the plant by a constant flow of clear water. The city manager's idea was that the plant was overloaded and that he would replace it by a larger one as soon as the citizens would vote the money to pay for it. The result shown by this article is that the plant is ample for some years and the fault has been in the operation, or rather lack of operation in the past.

The city is on a watershed boundary line so that it is rather flat and slopes in two directions, making two outlets and two small sewage treatment plants necessary, one at each end of the city. The sandy soil and level area mean much ground water, especially in the rainy season, which, however, flows slowly on account of the fineness of the sand. Tight sewer joints are evidently necessary to keep out both water and sand, but they were not secured and, moreover, a former city engineer, in an effort to reduce the cost of construction of considerable additions to the sewer system, made concrete pipe without expert workmen and supervision and these pipes have disintegrated with the result of much fine sand reaching the treatment plant during the rainy season. These defective pipes are being replaced as rapidly as they show up.

The plants are duplicates and one of them will be described since the other is in the line of a new state highway, construction of which is expected to begin soon after the official changes which may be made as results of the November elections. A design for a new plant has been made and duly approved by the State Department of Health.

The Old Plant.—The old plant, of reinforced concrete, is in plan a circle of 22 ft. inside diameter, the cylinder being 19.5 ft. inside and 21 ft. outside depth with a cone-shaped bottom of 6 ft. inside height, the 8 in. iron sludge pipe being set on feet at the lowest point, at the center of this cone. There are 4 ft. 9 in. of clear cylinder between the cone and the base of the two sloping bottoms of the sedimentation chamber, which is also the level of the bottom of a concrete hanging wall across the flow line of the sewage and serves as a brace across the cylinder; a wall dividing the sedimentation chamber into two parts so far as the sloping bottoms extend, and as a support for the walls between the sedimentation chamber and the gas chambers. The full sedimentation chamber is 18 ft. wide on top and where its vertical sidewalls intersect the outside cylinder walls it is 12 ft. long and 6.5 ft. deep. Below that depth there are two triangular bottoms each 9 ft. wide and 8.25 ft. deep over all. Up through the middle of the sedimentation chamber, over the sludge-cone bottom, and with the sludge pipe coming up through it, is a gas chamber or vent, 2 ft. wide and 5 ft. long in the direction of flow of sewage. The original plans show a branch to the sludge pipe which would let sludge flow out on opening a valve, but this was not put in and there is no way of getting the sludge out of the tank except by pumping through the sludge-pipe or through hose let down in a gas vent. It will be noted that the position of the outside walls of the sedimentation chamber leaves two lunes between the walls and the outside wall of the tank. These lunes are nearly 12 ft. long and have a maximum width of 1 ft. 8 in., the walls of the sedimentation chamber being 4 in. thick. These lunes serve as gas vents or chambers, making three chambers in all.

Cycle of Sewage Flow.—The sewage enters the tank through a 15 in. pipe with a T which distributes the flow in two directions. The sewage flows through the sedimentation chamber parallel to the bottom slots (1) across a lune about 5 ft. in center width; then (2) it flows under a creosoted wood baffle; thence (3) along 12 ft. of sedimentation chamber around the central gas vent and between the two side gas vents to another creosoted wood baffle under which (4) it passes to and through 3.5 ft. of a 5 ft. lune like the one at the inlet; whence (5) it passes over a weir into a lune-shaped channel with a bottom which leads it (6) to the 15 in. outlet pipe. The total distance of flow of sewage from inlet pipe to outlet weir in a straight line is not quite 20 ft. The surface of water in the tank (elevation of discharge weir) is 1.5 ft. below the top of the tank described above. It would be possible by a proper arrangement of surface and submerged baffles and channel walls to increase the length of flow of the sewage to perhaps 50 ft., but the normal dry-weather flow of sewage is so small that this was thought unnecessary at present although plans were made for such channels in case further increase in sewage results in too short detention in the sedimentation chamber.

Cause of Lack of Purifying Action.—The first step in revising the operation of the plant was to pump it out and clean it thoroughly. When this was attempted the reason for lack of purifying action in the old plant was shown. The tank was so full of sand that when the water was pumped out of one of the four sectors into which the sloping bottoms of the upper story and the cross wall divide the middle depth of the tank, it could not be drawn from

one of the adjoining sectors, showing complete stoppage of the lower story and of the slots supposed to lead sludge to it. It took several weeks to dig the sand out as it was too heavy and thick to be pumped out with the machinery at hand and the width of openings into the lower story was only the 20 and 24 in. in the gas chambers or vents, as above described. At the bottom some of the form boards for pouring concrete during construction were scattered about or still in place, practically stopping the slots. The time of building the tank was not ascertained but was certainly more than seven years ago. The attention which the plant has had since its construction is easily estimated. This would not be mentioned but for the fact that it is not exceptional. Several plants seen in both the north and the south seem not to have been touched since put in operation and most others are so ignorantly operated that the labor is practically thrown, away, if judged from the unsatisfactory results obtained.

Some of the operators of medium size plants with which the writer is acquainted have been able to reduce the nuisance about their plants during favorable seasonal conditions by rather simple but laborious treatment and it seemed probable that small plants might be greatly benefitted by similar treatment, particularly plants in the South where the temperatures in the treatment tanks are never low enough to reduce bacterial activity to a serious extent. Some preliminary experiments indicated that such operation of Imhoff tanks should be reasonably successful in plants treating domestic sewage, and that proper chemical control observations would lead to modifications of a program for a simple sewage treatment problem which could be made applicable to sewage of more complicated content on account of industrial or other wastes mixed with the house sewage. These experiments will be reported upon later. The present article is confined to the description of a strictly house-sewage treatment plant.

Additions to the Plant.—As a preparation for the treatment three additions were made to the Plant City design.

1. The preliminary tests showed that rags, large papers, and the like after settlement into the digestion chamber (lower story of Imhoff or similar plants) were lifted by formation of gas or otherwise and gathered on top of the gas vents, chambers or channels, as they are variously called. If the tanks were neglected this led to the decomposition of sewage meshed in the mass of rags and paper where aerobic action is pronounced and gave rise to very objectionable odors, not all of them from hydrogen sulphide. Insertion of a bar screen stopped these larger fibrous masses and the screenings were buried as raked from the screen.

2. A grit chamber was inserted to catch the sand as it arrived, this sand being removed daily or oftener if necessary in the rainy season, thus preventing hardening and excessive weight of the digested sludge. The necessary pumping of the digested sludge in the Plant City plant was thus made as easy as possible.

3. Water and under pressure enough to operate a 1½ in. nozzle if desired was piped to the plant.

The foreman was instructed to leave as much sludge as possible in the bottom of the tank when it was cleaned and at the same time to remove as nearly all the sand as possible. He did a good job as there seems to have been no trouble in starting the digestion of sludge in the tank as soon as the sewage was again turned in.

Daily Program of Operation of Imhoff Tanks.—The foreman was furnished with the following program and given instructions to follow it exactly and completely each day and especially to keep everything about the plant perfectly clean and to bury the screenings and sand from bar-screen and grit chamber as soon as removed therefrom.

1. Rake off the screen, breaking up any fecal matter so it can pass through the screen with the sewage.

2. Draw the sand out of the grit chamber, letting floating matter, except wood and rags, flow on with the sewage.

3. Collect the two above and put into wheelbarrow to be hauled off and buried. If held over to get a barrow load before burying odors will be given off.

4. Wash off the screen and walls above and below it, and the platform of the grit chamber, forcing the washings into the flow of sewage.

5. Use the hose in breaking up the scum on the surface of the sewage in all the sections of the tank formed by the baffle boards, working backwards from the outlet. Should there be much scum in the section at the outflow weir, shovel or dip it over into the scum chamber, so that it will not flow over the outlet weir.

6. Use hose or rake or both in breaking up the scum in the three scum chambers until it is soft and mushy and all lumps are broken up and thoroughly soaked with water. Be sure to leave all wall surfaces clean.

The above operations should be gone over every day. If properly done and frequently it should never require more than a couple of hours for one man, and may usually be done in an hour or less. The other operations, using hydrated lime or chloride of lime will be required at longer intervals, unless the plant should be neglected for a time, in which case hydrated lime should be applied daily until the plant is brought back into condition.

How to Prevent Odors from the Sewage Disposal Plant.—The city manager was supplied with the following explanatory statement of the foreman's program.

1. The plant **must be kept clean.** Whenever in the operation of the plant any of the sewage is spread on the walls or floors of any part of the plant, it must be washed off and the wash water run into the tank or into the stream of sewage running into the plant. This applies to screen and grit chamber as well as to the Imhoff tank. When any rakings from the screen or from the grit chamber are collected they must be buried or burned in incinerator, together with any polluted soil or vegetation. Whenever necessary fresh clean sand must be filled into holes made by shoveling out such polluted soil.

2. The scum which forms on the surface of the sewage flowing through the Imhoff tank must be broken up so that it can settle, at least once a day and oftener if necessary. This can be done best by means of a spray from a hose nozzle. If the spray is used to drive this scum back toward the entrance of the sewage into the tank there will be less floating matter driven under the baffles and so out of the tank without sedimentation and decomposition in the tank. This part of the work is easily and quickly done and if done every day, and the walls washed down, there will be no development of mosquitoes and flies in the scum.

3. The scum rising in the scum or gas chambers in the center of the tank and in those on the east and west sides may produce nuisance. To prevent this as much as possible, this scum should be broken up and mixed with water so that it will be soft and quite liquid. This should be done every day and can be done with water from the hose or by means of a rake or squeegee or hoe, or partly by water and partly by hoe. The scum will not all settle but can be kept odorless by this breaking up every day. Any scum forming in the iron pipe from which sludge is pumped should be broken up also. If this breaking up of scum is neglected for 3 or 4 days flies and mosquitoes will develop, even in the sludge pipe.

4. If the scum thickens to a depth of a foot or two and cannot be reduced by the operations described under (3), mix as much hydrated lime in a pail of water as it will carry and spread a pail of this lime water over the scum in each of the three scum chambers. Keep this up each day as long as is necessary to work the sludge down to the ordinary thin layer. If for any reason these scum chambers should be neglected for a few days, considerable odor will develop and more lime water must be applied when the scum is broken up, say 5 or 6 pailfuls in each chamber, or even more, each day until the odor is stopped. Keep all tank surfaces clean.

5. Do all the work carefully so as to help the floating matter to settle and to stir up the floating matter below the surface as little as possible so that little

will flow out through the outlet. Should odors develop in the ditch below the plant, which may happen when the ditch runs dry, as it may in the winter season, they may be reduced by dosing the outflowing stream at the plant with chloride of lime. That these odors will be serious is not probable. The amount of chloride of lime and the manner of applying it cannot be predicted in advance. Possibly the quickest and most effective action under your conditions would be to siphon out of a barrel of solution of chloride of lime drawn along the bank of the ditch, enough to stop the formation of odors by the decomposition in the ditch. A single treatment may be sufficient, or possibly one a week until you have rainfall enough to wash out the ditch.

6. Ordinarily sludge should be pumped out about once in three months. If there is any odor or any gas observed in the sludge as it is pumped it is not yet fully digested and pumping should be stopped and the sludge be left in the tank for several weeks before pumping again. If left in the tank long enough to be fully digested the sludge will have no odor beyond a slight musty odor and when dried can be used for filling or grading. Should any flies develop about the wet sludge, sprinkle it with chloride of lime enough to kill the larvae before they hatch any more flies, or haul the sludge off and cover it with a sprinkling of sand enough to absorb the surplus water in it.

The Results at Plant City.—The writer was absent from the state during the summer months, during which time the screen and grit chamber were installed, the tank was cleaned out and put into operation. A visit late in September showed everything to be operating perfectly and the only odor about the plant was a slight odor from the fresh sewage as it passed into and through the screen and grit chambers. As they are covered with removable plank covers this was scarcely noticeable even when the covers were lifted for inspection. The visit was paid during the week after the heaviest West Indian storm on record, during which about 10 in. of rainfall was the record for 24 hours at Lakeland, about 6 miles east. Enough water had come through the sewer to overflow the screen chamber, but the sewage was so greatly diluted and the outlet ditch was so near by that no odors were developing.

Although constant operation on the program as laid down will prevent development of flies and mosquitoes, removable screens (sectional) were laid horizontally over the tanks, resting on the various division walls and baffle boards to make them easy to handle and will prevent this nuisance in case operation daily is intermitted for a time. During the rainy summer season the sewage is less in Florida towns, because of lack of tourists, and the dilution is great, even in this separate system of sewers, for the reasons given above. It is possible that operation of the program every other day or twice a week might be sufficient. However, the work on the experimental plant above referred to indicates that daily operation is necessary for the larger population and greater sewage concentration of the dry season, covering fall, winter and spring. Intermission of the program for two or three days makes scum harder and thicker and requires more squeegee and water work and also use of lime so that there would be but little if any saving of time over daily operation.

The operation of the plant during the following winter season will be watched with interest and any changes in operation or any correction of abnormal conditions will be carefully worked out under the methods of control worked out and now under study in the experimental plant.

Other articles on plants which are working for like results under conditions much more difficult will be given from time to time, with the hope of deriving some standards with which to attack the problems where they are fairly uniform, as they are in Florida, as well as to show what needs or does not need to be done in separating wastes which destroy uniformity in constitution of sewage either by varying constitution of such wastes or by irregular discharge into the sewer system. Neutralization of the effects of frost is being worked on by every sewage plant engineer or operator. The work in the simpler plants may solve many partial problems making it easier to work out a solution or solutions for the most difficult one.

Urges More Parks and Playgrounds as Highway Safety Measure

A vigorous plea for the construction of more public playgrounds in cities, and foot paths along country roads has been made by the American Road Builders' Association.

"The unwarranted slaughter of children by motor cars and trucks is linked closely with the general problem of safeguarding pedestrian traffic," stated Chas. M. Upham, secretary-director of the Association. "Statistics show that 7,400 children of school age were killed on the highways of the United States in 1927, and of these children, 3,638 were killed while at play in the streets. More than twice as many children between the ages of 5 and 10 years were killed than of any other similar period of years."

In discussing this problem of child safety Mr. Upham states, "There are entirely too few playgrounds and recreation centers and children in many cities are forced to play in the streets. Roller skating on highway pavements should be discouraged, as well as tobogganing, coasting or sledding.

"Public school officials, parent-teacher associations, churches, civic organizations and parents, in particular, are urged to promote the establishment of public and private playgrounds in cities and towns, with a view to affording children a greater number of safe places where they can play."

"More than $1,000,000,000 have already been invested in public parks and playgrounds, covering 250,000 acres, all told, and more than $100,000,000 is being expended annually for their maintenance. Practically all cities with more than 25,000 population have at least one park or playground but many millions of children, especially in the smaller cities, do not have access to parks or playgrounds and all too frequently go into the streets. These children should be encouraged to play upon vacant lots where possible. They must be kept off the streets.

"Investigation of highway accidents in which children are the victims shows that the principal causes are roller skating; playing in the street; sledding and coasting; stepping from behind passing or parked automobiles or trucks, or in front of backing ones; walking or running in the highway; running around a passing street car; darting out from the curb without observing traffic; hopping on automobiles or trucks, and similar bits of recklessness. Most of the accidents occur during the school vacation periods.

"During the school year the accidents occur principally on Saturdays. Children from 5 to 10 years of age are the most frequent victims. The most dangerous period of the day is from 4 to 6:30 P. M., when the children are more likely to be in the streets and when traffic congestion, due to the rush hours, is heaviest. The slaughter annually of approximately 7,000 future citizens of the United States by motor cars and trucks on our highways can be practically eliminated through education and the exercise of proper caution. Regulation of pedestrian traffic along with vehicular traffic is one remedy that is beginning to receive serious attention.

"Formation of schoolboy patrols, class room instruction in the public, parochial and private schools, posting of safety bulletins and constant warning from parents will go far to promote caution among the children and minimize the number of child accidents."

Water Works in Kansas.—According to statistics collected by the League of Kansas Municipalities there were 261 water works in Kansas on Jan. 1, 1923, 264 on July 1, 1925 and 283 on July 1, 1927. All the water works with the exception of six are municipally owned.

Asphalt Cold Mixes for Re-surfacing Roads

Methods and Costs of New Product Explained

By ALLAN K. HAY
Engineer to Ottawa Suburban Roads Commission, Ontario

DURING the past few years the Ottawa Suburban Roads Commission has been developing the use of asphalt cut-back mixtures for construction and resurfacing of heavily travelled highways. These mixes are prepared and spread without heating, being composed of crushed stone and an asphalt cold-patching product and are used at certain locations where the size of the work is too small to attract bids from contractors building the more usual types of hot mixed pavements. In the summer of 1928 a distance of 2.6 miles was built on the Metcalfe Road, which forms a link on one of the main highways between Ottawa, the Canadian capital, and the New York State boundary. On account of the heavy tourist traffic it was desirable to build a type of surface which would not require motorists to detour.

The existing road was a penetration macadam in fairly good repair but having a wavy and irregular driving surface and width of only 15 to 16 ft. with heavy annual shoulder maintenance. This roadway was used as a foundation without scarifying in any way, but was first widened by the addition of a strip of concrete, 6 in. in depth, the new width attained being 18 ft. on straight road and 20 to 26 ft. on curves, of which there are many.

On completion of the widening 3x6-in. planks were set along the edges and the new surfaces spread and compacted in two courses, the lower course of about 1½ in. to 2 in. and the upper course of 1-in. depth after consolidation. On completion a seal coat of premixed sand and asphalt cold-patch was broadcasted and rolled over the finished pavement. Traffic was allowed to proceed through the work at all times.

Mixing Plant.—The mixing plant for this work is very simple and exceedingly economical in cost. It is in fact merely an extension of the practice of using a small concrete mixer for cold-patching on roadway repair work. The plant operated on this job consisted of a second hand steam-driven concrete mixer with a tilting drum having a capacity of about 13 cu. ft. of coarse aggregate, this being mounted below a substantial timber platform and near a stone crusher. In operation, crushed stone is conveyed from the crusher bins to this platform, is dumped into the hopper of the mixer, the requisite quantity of asphalt cold-patch is added and the mixer discharged into trucks below.

Asphalt cold-patching material was used, having a somewhat higher bitumen content than that commonly supplied for patching work.

All stone was crushed to pass a 1¾-in. ring and was separated into two sizes:

A, from ¾-in. to 1¾-in.

B, from ¼-in. to ¾-in.

the dust of crushing being also separated and not used in the mix.

Size A was used for the first course and size B for second course.

It will be noted from the above that no attempt was made to approximate a graded asphaltic concrete mix by the addition of sand or other fine material, as such a procedure is impractical with cold-mixes of this type. The whole process was based on the theory that stability in the finished roadway would be obtained by the mechanical interlocking of the individual stone particles in the same way as in penetration macadam.

The finished pavement was covered with a rich mix of cold-patch and coarse sand, spread and rolled to an amount just sufficient to fill the surface voids and thus waterproof the whole. This sand seal coat worked out at a weight of 12½ lb. per square yard, the total weight of the whole new pavement averaging 295 lb. per square yard. This amount was governed largely by the condition of the old foundation, surfaces of greater and of less unit weights having been laid on other roads. On work of this kind a surface treatment with hot liquid asphalt is usually applied one year after construction and produces a finished pavement which compares favorably in appearance with hot-mixed types. The Commission has built short stretches of similar roadway, some of which are four years old and are giving excellent service under heavy traffic and severe climatic conditions.

Cost per Mile

Widening old roadway with concrete	$1,240
Cold-mix surface	8,000
Grading (earth shoulders and embankment)	3,640
	$12,880

Cold-Mix Surface

	Cost per ton of mixed product	
(1) Mixing:		
Setting up plant	$0.057	
Labor mixing	0.705	
Asphalt cold-patch	1.467	
Crushed stone and sand	1.300	
Coal for mixer	0.032	
Plant rental, overhead and sundries	0.193	$3.754
(2) Cartage from mixer to road: (Average haul 1.3 miles)		0.340
(3) Spreading and rolling:		
Labor	$0.564	
Plant rental, etc.	0.126	0.690
Total		$4.784

At 295 lb. of cold-mix per square yard, this is equivalent to 71 ct. per square yard. The following data are pertinent to the above costs:

Ten hour day.

Foreman, 55 ct. per hr. Roller-man, 75 ct. per hr. Mixer operator, 50 ct. per hr. Labor at 40 ct. and 35 ct. per hr.

Crushed stone at contract price of $1.30 per ton delivered at mixer.

Cartage contract at 34 ct. per ton.

Asphalt cold-patch used at rate of 7 gal. per ton of mixed product and cost 23 ct. per Imperial gallon (not U. S. gallon) delivered in barrels at mixer about 11 mi. from R. R. siding.

Portland cement $2.55 per bbl. delivered on road.

Coal $9.50 per ton at mixer.

All material weighed on 10-ton platform scale located in quarry. Cost of weighing included.

Meetings of the National Highway Traffic Association

The following list of meetings of the above association have been announced. Programs can be obtained by addressing the Workshop, National Highway Traffic Association, 12 Dennison Bldg., 515½ Jefferson Ave., Toledo, O.:

Dec. 3, 1928: Meeting of South Central Division of the National Highway Traffic Association, Hotel Roosevelt, New Orleans, La.; secretary, Elmer Thompson.

Dec. 10, 11 and 12, 1928: Annual meeting of the National Highway Traffic Association, Automobile Club of America, New York City; secretary, Elmer Thompson.

Jan. 15, 1929: Meeting of the North Central Division of the National Highway Traffic Association, Cleveland Hotel, Cleveland, O.; secretary, Elmer Thompson.

Jan. 17, 1929: Meeting of the North Atlantic Division of the National Highway Traffic Association, Automobile Club of America, New York City; secretary, Elmer Thompson.

May 13, 14 and 15, 1929: Annual convention of the National Highway Traffic Association, Stevens Hotel, Chicago; secretary, Elmer Thompson.

Pictures of Construction on Metcalfe Road by Ottawa Suburban Roads Commission

Fig. 1—Showing Use of Old Steam Driven Concrete Mixed for Preparing Cold-Mix Material. Fig. 2—Cold-Mix Surface Construction, Village of Radcliffe, in 1927, on About 10 Per Cent Grade. Fig. 3—Showing Spreading of Batches on Same Job as Fig. 2. Fig. 4—Showing Mixing Plant and Platform Over Mixer

Are Essentially Uniform Municipal Traffic Regulations Utopian?

An Interesting Discussion of an Outstanding Problem

By ARTHUR H. BLANCHARD

Consulting Engineer, National Highways Association, and President, National Highway Traffic Association

WHAT is meant by essentially uniform municipal traffic regulations? The stress is on the phrase "essentially uniform." Why? Because there is a vast difference between municipal traffic regulations which are uniform based on the desires, it may be said the demands, of motorists and operators of trucks and buses, and municipal traffic ordinances and regulations, which might be identical, in every city, incorporated and unincorporated village, and hamlet in the United States.

What an Ordinance Should Cover.—What should be the underlying fundamental principles upon which should be based traffic regulations formulated for adoption in every municipality throughout our land? An "essentially uniform" traffic ordinance should definitely cover every traffic regulation which cannot be readily and practically indicated by signs and signals.

Safety of pedestrians and vehicular operators positively requires that signs at street intersections should be of a number approaching the irreducible minimum as the desirable limit. For example, when we find the vehicular operator required to read numerous signs such as "No U Turns," "Right Turns Prohibited Between 4:00 and 7:00 P. M.," "Lane at Curb for Right Turns," "Left Turns Only Permitted by Direction of Traffic Officer," "Thru Street, Speed, 35 Miles per Hour," "Hospital District, Quiet," "School Zone, 10 Miles per Hour," and "Lane Next Center for Left Turns," how are we to expect the bewildered motorists will be able to cooperate with the National Safety Council and assist in reducing automobile accidents and fatalities?

The Model Ordinance.—The latest attempt to formulate, promulgate and have unanimously adopted a "Model Municipal Traffic Ordinance" was sponsored by the Hon. Herbert Hoover. The product of the brains of practically one hundred men comprising the committee has been published and distributed broadcast. What of the result? In the opinion of many, it is not as satisfactory as its framers anticipated, from the standpoint of that fundamental desideratum, namely, "essentially uniform."

The "Model Ordinance" is not 100 per cent satisfactory because it contains, relative to several important sections, the dictum. "If you don't like this traffic control recommendation, please adopt the following alternate regulation."

Two examples of alternate regulation embodied in the "Model Ordinance" follow:

Traffic Control Signal: Primary recommendation, three-color system; alternate recommendation, two-color system with a different meaning for the red signal than in the case of the three-color system.

Car Track Adjacent to Safety Zone: Primary recommendation, driving on car track permitted; alternate recommendation, driving on car track prohibited.

Why the Alternate Regulations Were Included.—The reasons for the inclusion of the alternate regulations are apparent to anyone familiar with the formulation of traffic ordinances. Sidney J. Williams, Director of the Public Safety Division of the National Safety Council, hit the proverbial nail on the head when he said "There are a hundred million traffic experts in the United States."

To Discuss Controversal Regulations.—In the hope that the basic facts underlying the reason for the marked differences of opinion relative to controversal traffic control regulations may be analyzed and that solutions of the related problems may be finally found, the Executive Committee of the National Highway Traffic Association has placed on the program of the New York Annual Meeting, to be held on Dec. 10th, 11th and 12th at the Automobile Club of America, progress reports of National Committees to which have been assigned many of the bones of contention which developed at the meetings of the Hoover Committee.

Is there any hope for the adoption of an "essentially uniform" municipal traffic ordinance? The reply is in the affirmative. The method proposed may savor of Il Duce, but it must be remembered that Mussolini has accomplished wonders in Italy for which he probably will be classed as a "Saint" by succeeding Italian generations.

Hope for Relief.—There is a "Star of Relief for Traffic Control Chaos" slowly rising at Washington. When Congress shall have passed a bill providing for the establishment of a system of National Highways, as advocated by the National Highways Association and comparable to that under the jurisdiction of the National Department of Roads and Bridges of France, then we may hope for the adoption of an "essentially uniform" municipal traffic ordinance.

As the states now adopt legislation which controls traffic on their highway systems, it is natural to presuppose that Congress will empower the United States Bureau of Public Roads, a National Highway Commission, or the Interstate Commerce Commission to formulate and enforce regulations applicable to traffic on all highways comprising the National System.

The effect on state regulations will be apparent. It is not conceivable that the motoring public would long tolerate one set of regulations controlling traffic on National Interstate Highways within a given state and different regulations on the intrastate highways outside of urban districts.

As the National Traffic Regulations would apply to incorporated and unincorporated villages, and small and large cities, the gradual adoption of an "essentially uniform" municipal ordinance naturally would follow and order out of chaos would be forthcoming.

Acknowledgment.—The above paper was presented Oct. 23 by Mr. Blanchard at the Detroit convention of the American Society for Municipal Improvements.

Model Airport for Philadelphia

It has just been announced that the contract for design and superintending construction of the Central Airport at Camden, New Jersey, has been awarded to Black & Bigelow, Inc., Air Transport Engineers of New York City.

This airport is ideally situated on the main road between Philadelphia and Atlantic City, only four miles from the Philadelphia City Hall. The property comprises about 184 acres and is owned by Central Airport, Inc., an organization recently formed by Messrs. C. T. Ludington, C. M. Keys, Harold F. Pitcairn, N. S. Ludington and other leaders in the aviation industry.

The design of the airport will be placed in the hands of Mr. Archibald Black, president of Black & Bigelow, Inc., and construction work will be in charge of Mr. J. C. Worthington, construction engineer of the same firm.

Electric Pumpage at Kansas City, Mo.

New Stations Have 13,200 Volt Motors and Electric Radiators

By ALBERT L. MAILLARD
Consulting Engineer, Kansas City, Mo.

IN the new $11,000,000 addition to the water works of Kansas City, Mo., there are included three pumping stations, one high lift and two low, all of which are electrically operated. Moreover, the power for these electrically driven pumps is purchased from the Kansas City Power & Light Co.

The Original Studies.—In the original studies made by Fuller and McClintock in 1920, steam driven pumps were considered for all stations. Later studies pointed to part steam and part electric drive. This latter scheme contemplated a high lift steam driven pumping station and electric power plant combined, thus confining all steam generation to one central location. The low head stations were to be electrically operated with power transmitted from the power plant. There were very good reasons for this change of plan. Among them were these:

1. The economical and best layout dictated two separate stations, a low lift to pump the water from the river to the purification works, and a secondary lift to pump the water through the tunnels to the reservoirs at the new and existing high head stations.

2. In consequence of the above each station had a capacity of about 2500 H. P., which is comparatively small for efficient steam generation.

3. There were several small pumps such as those needed for wash water, house service, etc., which would not lend themselves to economical steam drive.

4. The chemical plant, Dorr clarifiers, and sump pumps, cranes, etc., in addition to lighting, called for a great deal of electric power.

5. Due to the low floor elevation necessary at the Low Lift station the substructure was rather expensive. Steam drive with condenser and auxiliary equipment needed a great deal more room than did electric drive.

6. The losses in generating power and transmitting it would be offset by the better efficiencies gained in a centralized steam generating plant with larger units and lower unit labor costs.

The combined pumping and electrical loads at the high lift station in the East Bottoms was between 17,000 and 20,000 H. P. The cost of this combined station was estimated at about $3,000,000. The estimated cost of the entire additional works was approximately $20,000,000, but bonds were issued for only $11,000,000. Accordingly, some means of reducing costs had to be adopted. Purchased electric power offered a solution of pumping station economies in capital investment. The rates offered by the Kansas City Power & Light Co., when figured at certain load factors, compared very favorably with costs based on steam operation. Up to the present, however, these load factors have not been attained, due to a change of plan regarding the relative amounts of water pumped by the steam station at Turkey Creek and the electric station at East Bottoms, and the resultant power rate is not as low as was figured. Correspondingly so, would operating costs at East Bottoms station for steam drive have been affected had it been adopted.

The Unique Power Contract.—Because of the fact that two local utilities competed with each other and with the consulting engineers' estimate of steam costs, a very interesting three-cornered fight ensued, with the result that the city was able to procure a contract that is unique in several ways, and rates that should result in an average cost of one cent per kilowatt hour if original load factors on electric pumpage be attained.

Some of the outstanding features of the contract are these:

1. That the city shall have first call on the power plants of the company.

2. That duplicate feeders, of very liberal capacity, shall connect the stations with the power plants by two separate and independent routes.

3. That no other consumers shall be served by these feeders.

4. That no substations shall intervene between the pumping stations and the power plant.

5. That the established demand be calculated on a monthly average of half hour peaks rather than on an individual half hour.

6. That peak demands due to large fires, or emergency due to breakage of large mains, etc., be not considered in establishing the demand charge.

7. That the peak months for water pumpage, namely, June, July and August, be not considered in establishing the maximum demand but be treated as individual months.

8. That a credit or debit be allowed or charged with the fluctuations in the cost of fuel regarding a certain price as a base.

9. That a reduction in the demand charge be made based on 80 per cent power factor. Maintenance of 100 per cent power factor reduces the demand charge by 20 per cent.

Since the city has installed synchronous motors on all its major pumping equipment it is easy to maintain 100 per cent power factor.

The following are the rates:

Demand Charge: $1.56¼ per month per kilowatt, plus $3,000 per month to cover charges on transmission lines.

Energy Charge: $0.007 per kilowatt hour until the demand at the high lift station exceeds 2,800 kilowatts; $0.00675 per kilowatt hour until the demand at the high lift station exceeds 4,250 kilowatts; $0.0065 per kilowatt hour until the demand at the high lift station exceeds 5,600 kilowatts; $0.00625 thereafter.

The life of the contract is 20 years, but it may be terminated upon the giving of due notice by the city, should the company fail to give first class service.

The Pumps.—When steam drive was considered for the high lift station, 35 M.G.D. pumps were selected, but with electric drive, using synchronous motors, the capacity was changed to 24 M.G.D. contemplating six of the latter in place of four of the former. At the low and secondary lift stations 35 M.G.D. pumps were selected. One pump in each of these latter named stations, however, is equipped with a 20 M.G.D. impeller.

On account of the wide variation in head at the low and secondary lift stations the capacities stated are obtained only at average heads. The heads at the Low Lift station vary from 18 to 51 ft., while those at the Secondary vary from 14 to 48 feet. These wide ranges of head presented quite a problem and the question of using two speed motors received considerable study. A careful examination of records of river stages covering several years of observation brought out the fact that during eighty per cent of the time the heads at the low lift station could be expected to vary between the limits of 39 and 48 ft., including suction lift. For the same percentage of the time it was found that the heads at the secondary lift station would vary between 32 and 44 ft. These estimates are based on normal operation of the works when supplying all of the needs of the city.

Synchronous Motors Used.—Based on the narrower limits of head variation, it was decided to use synchronous rather than two speed induction motors. The former had the advantage of better efficiencies during eighty per cent of the time, better power factor at all

times, less operating complications and slightly less cost; while the latter afforded better pump efficiencies for twenty per cent of the time. The power factor clause in the power contract was a determining factor in the decision.

The pumps at the low and secondary lift stations are of the double suction, single stage, volute type with 36 in. suction and 30 in. discharge nozzles. The casings are of cast iron, are split horizontally, with suction and discharge nozzles in the lower half and placed horizontally. The speed is 360 revolutions per minute. The short life of high speed impellers due to the cutting effect of the Missouri River sand was the reason for selecting such a low speed. For obvious reasons the same speed was selected for the secondary lift pumps.

Owing to the wide range of head under which these pumps were to operate, a minimum capacity of 32 M.G.D. was specified at 51 ft. total head at the low lift station and at 48 ft. total head at the secondary station. The manufatcurers were asked to produce as flat a capacity curve as possible and were given three heads at which they were to make efficiency guarantees. The following is a tabulation of results obtained in field tests and which were somewhat better than those guaranteed:

Total Head in Feet	Capacity in M G.D.	Efficiency in Per Cent
32	**44.0**	**80.5**
38	40.5	84.0
44	36.0	86.0
48	**32.1**	

No efficiency guarantees were asked at 48 ft. head. The above is the result of a test on one of the pumps at the secondary lift station and is typical of all the pumps at this station. The efficiencies of the pumps at the low lift station are somewhat higher, but both the efficiency and capacity curves have the same characteristic of flatness that is peculiar to those obtained from the pumps at the other station. The pumps in which the 20 M.G.D. impellers are installed show efficiencies varying from two to three per cent lower than those of the pumps with the larger impellers. Of course the 20 M.G.D. impellers are merely a temporary measure.

The Main Pumping Equipment.—Summarizing, the main pumping equipment at the low and secondary lift stations comprises one 20 M.G.D. and three 35 M.G.D. pumps, with room for a future unit, in each station. Maximum head conditions at the low lift station occur when maximum demand and minimum river stage coincide. At the secondary lift station maximum head depends on demand, the elevations of the clear well and of the reservoirs at the high lift stations. Since at maximum heads the pump capacities are reduced to 32 M.G.D. and 18 M.G.D., the total capacity of the stations under maximum head conditions is about 114 M.G.D. It is not probable, however, that maximum demands at the low lift station will occur simultaneously with minimum river stage, for which reason this station capacity will be in excess of 114 M.G.D. during periods of maximum demand. At the secondary lift station all pumps were put on the line, the head was about 49 ft., and the total capacity of the station was 116 M.G.D.

Outside of the characteristics mentioned above there is nothing unusual about these pumps nor about their installation and method of operation. They must be started against a closed discharge valve so as to keep the "pull in" torques of the motors down to a limit where best overall motor efficiency may be obtained. The pumps are primed by vacuum pumps, of the Nash Hytor type, two in each station. Those at the secondary lift station are controlled automatically by vacuum gauges acting on the motor controllers. The piping at both stations is so arranged that one or both vacuum pumps may be used to prime any of the main pumps.

The Service Pumps.—In addition to the main pumping equipment at the secondary lift station there are three wash water and four house service pumps. The former are of 2500 G.P.M. capacity and operate against a head of 75 ft. Of the latter, two are of 500 G.P.M. and two of 250 G.P.M. capacity, all operating against 100 lb. pressure. The wash water pumps may be controlled from the filter galleries. The electrical control will be discussed later. The center lines of the pumps are at about elevation 23.0 and since the clear well is normally kept above this elevation, the pumps are normally primed. The piping is such that the pumps discharge into the wash water tanks or directly into the filters depending upon the operation of certain valves. The house service pumps supply water to a tank the average elevation of which is about 230 ft. This tank furnishes pressure water for operating valves, for fire hydrants, for domestic and other uses about the plant.

Pumping Units at East Bottoms.—The two pumps at the new high lift station, known as the East Bottoms pumping station, are of the horizontal shaft, two stage, type, consisting of two double suction, volute type pumps connected for series operation. The series piping is located under the operating floor. The casings are of semi-steel, split horizontally with suction and discharge nozzles in the lower half. Both nozzles are 20 in. in diameter, the suction pointing directly downwards and the discharge horizontally. These pumps are supposed to deliver 24 M.G.D. at 390 ft. total head while running at 720 revolutions per minute. The following is a tabulation of results obtained in field tests on one of the pumps. The other showed slightly less capacity and efficiency, but the average of both pumps met the guarantees.

Total Head in Feet	Capacity in M.G.D.	Efficiency in Per Cent
370	26.4	85.5
390	25.0	86.5
410	23.2	85.8

Since the initial installation, new 12 M.G.D. impellers have been installed in one of the pumping units. Recent field tests on this unit show the following:

Total Head in Feet	Capacity in M.G.D.	Efficiency in Per Cent
370	13.4	82.75
380	12.8	82 50
390	12.2	82.50
400	11.65	82.50

There is nothing unsuual about these pumping units. One great advantage that electric drive affords is that of the ease and speed with which a unit may be started and stopped. Normal operation provides a basin elevation that is high enough to make priming unnecessary. Omitting priming, a unit may be started and its full capacity placed on the line within 1½ minutes. The shutting down process consumes but 16 seconds, that is, from the time that the oil circuit breaker is tripped until the pump comes to rest and the check valve is closed. The sequence of operation will be discussed under the electrical features.

Since continuity of service is one of the prime requisites of the driving power for a direct pumpage system, it is necessary that the electrical layout provide sufficient duplication and flexibility to insure this service.

Electricity Supply.—The entire works in North Kansas City are fed from an outdoor sub-station which is the property of the city. Power is obtained from the Kansas City Power & Light Co., at 13,200 volts over two feeders, one overhead and the other underground. The sub-station equipment comprises two 2,500 K. V. A. banks of transformers connected delta-delta. Each transformer is rated 833 K. V. A., 13,200/2,300 volts, single phase, 60 cycles and is equipped with conservator and temperature indicator. These capacities were chosen on the basis that when overloaded 25 per cent one bank can carry 90 per cent of the ultimate load of the works.

The two incoming feeders form a loop and are protected by directional relays. The overhead line is provided with an oxide film arrester. Each bank of transformers is controlled by an oil circuit breaker on the high tension side as well as on the low tension side and is differentially protected. A tie line breaker on the high tension side provides flexibility while the low tension side is connected to a bus which is sectionalized by disconnecting switches. From this bus four feeders, two to each station, supply the low and secondary stations. Each station is fed by two feeders one from each section of the transformer low tension bus.

At this station the power is metered on the high tension side. Duplicate

sets of metering transformers, one for the company and the other for the city, are installed on the structure. Duplicate sets of meters are located on the switchboard of the Secondary station. The metering equipment consists of recording demand and power factor meters and integrating watt hour meters.

Motor Power Drive.—Each of the main pumps in the low lift station is driven by a 400 HP., unity power factor, synchronous motor operating at 2,300 volts, 3 phase, 60 cycles, 360 R. P. M. The excitation for these motors is supplied by two 30 K. W., 125 volts direct current, motor generator sets. Each set is capable of furnishing excitation for five motors. These sets may be used for lighting in case of failure of the lighting transformer.

The control for this electrical equipment comprises a fourteen panel switchboard, the material of which is asbestos board, finished in natural black. This board is mounted on the gallery floor, 28 ft. above the pump room floor. A technical remote control system through bell cranks and pull rods operate the oil circuit breakers which are supported on a pipe framework and located on another gallery 12 ft. below the switchboard floor.

The main bus is sectionalized by two oil circuit breakers. In the section between these breakers there is connected a station service feeder which serves power, lighting and heating transformers. Each outside section of the bus is fed by an incoming feeder, each having the capacity of the entire station. One section serves two motors while the other serves the remaining two motors and will serve the future unit.

Motor starting is accomplished by means of compensators and a starting bus. This bus is sectionalized by disconnecting switches, each section being connected to a compensator. Each compensator has enough capacity to permit of four starting operations within ten minutes without excessive heating of the compensator.

Auxiliary power for operating vacuum pumps, sump pumps, motor generator sets, crane and gate valves in this building as well as the revolving screens in the intake is obtained from 3-25 K. V. A., 2,300/230 volt transformers connected delta-delta. The lighting transformer is rated at 15 K. V. A., 2,300/230/115 volts.

Both the intake and the low lift stations are heated electrically and are served by a 150 K. V. A., 3 phase, 2,300/230 volt transformer. Industrial oven type, 220 volt ribbon element heaters suitably backed with reflecting and insulating material and provided with grille work in the front, are placed along the gallery in a manner similar to steam radiator practice. In most locations two elements are used to form one radiator, but they are individually controlled by local switches so that flexibility in controlling the heat may be obtained.

At the secondary lift station the main pumping equipment is a duplicate of that at the low lift station, consequently the electrical equipment is similar. The wash water pumps are driven by 75 HP., 2,300 volts, 3 phase, 60 cycles, 1,800 R. P. M. squirrel cage induction motors. They are controlled by automatic "across-the-line" contactors and push button switches. The latter are located at three different places, one at the contactor and one in each filter gallery. The latter are connected in parallel with each other and in series with that at the contactor. An oil circuit breaker controls each pump circuit. The 500 G. P. M. house service pumps are driven by 60 HP., 2,300 volts, squirrel cage induction motors which are started right across the line by merely closing the oil circuit breakers. The 250 G. P. M. house service pumps are driven by 25 HP., 220 volts motors and are controlled by starting compensators.

In addition to these pumps all the power used in the chemical house, filter house, Dorr clarifiers and the lighting for all these buildings and the grounds are controlled from the switchboard in the secondary lift station.

The Switchboard.—The switchboard comprises twenty-one panels and the system is that of mechanical remote control with the main breakers and bus located in a room on the lower floor beneath the switchboard. The starting bus with its compensators and breakers are located at the back of the switchboard. The busses are sectionalized in a manner similar to those at the low lift station, but here there is one breaker for auxiliary power and one for lighting. There is no electric heating in this building.

The auxiliary power transformers comprise 3-75 K. V. A., 2,300/230 volt units connected delta-delta. Multiple lighting is served by a 75 K. V. A., 2,300/230/115 volt transformer and series lighting by an 8 K. V. A. constant current transformer.

At the East Bottoms station the pumps are driven by 2,000 HP., 8 power factor (leading) 13,200 volts, 3 phase, 60 cycle, 720 R. P. M. synchronous motors. They are equipped with direct connected exciters which supply 125 volts to the fields. They are provided with temperature detectors of the resistance type and are equipped with enclosing end bells to cut down noise.

The switchboard comprises fourteen panels at present, but is expected to be expanded ultimately to twenty-one. The system is that of electrical remote control, some operations being performed manually while others are automatically controlled by relays and interlocks. The front of the switchboard faces the pump room while access to the back is had from the switch house. The material is asbestos board finished in natural black. All panels are of the same width, namely 24 in.

With the exception of the auxiliary bus for light and power transformers, all busses, switching equipment, instrument transformers, compensators, etc., are enclosed in a monolithic concrete cell structure, with each phase in a separate cell. The auxiliary bus is mounted on a structural steel frame work and is totally enclosed, the top and part of the sides being protected with transite board.

The station is fed by two underground lines direct from the company's power house bus. Ultimately there will be four such feeders. These feeders are installed in duct lines, each line taking a different route from the power house to the pumping station. The main bus in the station is in duplicate, but may be made one continuous bus by closing the tie breaker at one end of the bus structure.

Motor starting is accomplished by compensators and starting bus as in the other stations, but in addition "neutral" breakers are used to provide a smoother transition from starting to running voltage. Motors have 85 per cent pull in torque and full voltage is applied before the field circuit is closed.

The control circuit is fed by an MVSX Exide battery. A small motor generator set of 3 K. W. furnishes the trickle charge for the battery.

Operations in Starting a Motor.—At this point the sequence of operations in starting a motor might be interesting. First, the neutral breaker is closed manually, which automatically closes the compensator breaker. Next, the starting breaker is closed manually. An accelerating relay controls the next steps. As it closes, it trips the neutral breaker which automatically closes the running breaker. The field breaker is then closed manually and the compensator breaker tripped by hand, which operation automatically trips the starting breaker. If the field breaker be not closed within ten seconds after closure of the running breaker, the field failure trips the running breaker.

With the closing of the running breaker a solenoid valve on the automatic check valve is closed. This will be described more fully later. Due to the fact that this solenoid valve closes only after the running breaker is closed the motor "pulls in" against a closed discharge because the check valve cannot open while the solenoid valve is open.

In this station there is a 30 K. W. motor generator set which performs four important functions. It can supply excitation for any one or two of the main motors. It provides a source of direct current for lighting in case of failure of the lighting transformer. It can give a full charge to the battery. It can provide current for the control circuit while the battery is out of service or being charged.

Auxiliaries are fed from a bank of 3-25 K. V. A., 13,200/230 volt transformers. Lighting is supplied by a 25 K. V. A., 13,200/230/115 volt trans-

former. Emergency lights are fed from the battery.

Automatic Stop and Check Valve.—The description of this station would be incomplete without a word about the automatic stop and check valves. They are of the Johnson type and open and close automatically with unbalance of hydraulic conditions in the valve. The necessary unbalance of hydraulic conditions may be controlled by a solenoid operated valve in the blow off line of the main valve. The solenoid circuit is interlocked with the running breaker and a control switch on the switchboard is inserted in the circuit. With the closing of the running breaker the solenoid valve closes and permits the main valve to open as soon as the pressure on the pump side of the valve becomes greater than that on the line side. As soon as the running breaker trips out, the solenoid valve opens and the main valve closes. The control switch on the board permits the operator to open the solenoid valve circuit thereby opening the solenoid valve which in turn closes the main valve even with the pump operating at full speed. The operation of the main valve may be noted by the pressure gauge reading. This permits of the checking of one of the most important features of the station without disturbing normal operation.

The foregoing endeavors to describe, as fully as space will permit, the electrical and pumping equipment in the new works with special attention paid to the features which are unusual in waterworks practice. The use of 13,200 volt motors and electric radiators seem to be bold steps, and they are in waterworks practice, but in reality they are not new to the electrical industry.

It must be realized that when the works are put in full operation the city will be dependent entirely on electrical power for its water. Moreover, this electric power is being purchased from a public utility, namely, the Kansas City Power and Light Company. It is a great tribute to the reliability of electric public utility service and to the electrical industry as a whole. It is the writer's earnest hope that, as the years go by, no mishap will occur to shake the confidence so justifiably placed today.

Acknowledgment.—The foregoing is an abstract of a paper presented Oct. 4 before the Missouri Valley Section of the American Water Works Association.

Fatal Accident Locations on Ohio Highways.—Over 2,000 white crosses have been erected on roads in Ohio, since 1925, when the state director of highways began this method of marking the location of fatal accidents. The following table shows where the deaths have occurred.

	Per Cent
Straight sections of road	33
Railroad crossings	30
Curves or turns	18
Road intersections	7
Hills	6
Bridges	6

The Federation of Sewage Works Associations

A new technical association in the municipal field has been organized. This is the Federation of Sewage Works Associations. Its organization and purposes are set forth as follows by Chas. A. Emerson, Jr., chairman of the Federation in the first issue of its official publication, "Sewage Works Journal," issued last month.

"At the present time workers in the various branches of the sewage field, including operators of sewage and industrial waste treatment plants, scientists engaged in research, and municipal and private engineers interested in design and construction, are meeting annually in a number of our states for discussion of problems of mutual interest. These groups are known as sewage works associations, sewage and waste disposal conferences, and schools of instruction for water and sewage works operators. That the meetings are of real value to the participants is evidenced by the gradual spread of the movement; in fact, local sewage associations have been organized in two of our far western states during the past few weeks, and are being actively considered in at least four other states.

"It requires but slight imagination to forecast the formation within a very few years of state and district sewage works associations throughout the land, so that each worker may have the advantage of listening to papers and taking part in discussions with a minimum amount of expense for travel.

"Raising funds for publication of papers and discussions presented at these meetings has been a serious problem in all but one or two instances and resort to various expedients has been necessary.

"Sometimes a state department or a state university has issued the proceedings as a bulletin, and in other cases publication has been due to the generosity of business men's associations, or to a small group of manufacturers of sewage treatment plant supplies and equipment. Some associations have not been able to issue proceedings and no record has been made of contributions, presumably of considerable value.

"At the best, these proceedings have had a limited circulation, usually reaching only the members of the particular local association, even though the papers may have been of national interest and importance.

"In order for one person to receive the benefit of papers and discussions presented at all of these local associations, it would be necessary, under existing conditions, to pay dues in each and to attend meetings in various parts of the country, entailing an expenditure beyond the means of the majority.

"Ways and means for strengthening existing local organizations, for formation of others over a wider geographical range, and for providing a wider circulation of the papers presented at the various meetings so as to reach all interested workers at a minimum expense to the individual, have been widely discussed during the past two years. Other matters needing correction are the paucity of reliable and comparable data concerning operation of treatment plants; a lack of suitable outlets for sewage research papers, and wasted effort through presentation of practically identical papers at several different meetings.

"Workers interested in the solution of these problems have met in informal discussions held in connection with conventions of the American Society of Civil Engineers, the American Water Works Association, and the American Public Health Association. A committee of one hundred members, representing every section of the country, studied for several months, and, after rendering a preliminary report, gave way to four small committees working under a general chairman.

"Conclusions reached and recommendations made during this painstaking study were:

"1. That a national sewage works association with an annual meeting would be undesirable at present, because the expense for travel to an annual convention would be generally prohibitive.

"2. That desired results could best be obtained by strengthening the existing local sewage works associations and by the formation of others in each state, or in groups of two or three states taken as a unit, so that workers could attend meetings at minimum expense.

"3. That the local associations should be joined into a country-wide Federation and be guided by representatives selected by each of the local groups to act as a central board of direction.

"4. That a journal should be published by the Federation containing important papers presented at all the local meetings, together with proceedings of the meetings and original research articles for distribution to every member of each local association at a moderate price.

"As such a Federation was intended purely as a mutual benefit association, it was mandatory that arrangements be made to bring the costs within the means of all who might be interested. The publication of such a journal would be a matter of great expense and could not be entirely placed upon the member associations. For the solution of this financial problem appeals were made to a group of manufacturers of sewage works equipment and to The Chemical Foundation. Through their practical interest and generosity, together with the expenditure of much time and effort by individuals throughout the country, the Federation of Sewage Works Associations has been effected and the publication of the journal has become possible."

Sewage Treatment Plant at Grand Canyon National Park

Details of One of Most Interesting Plants in This Country

By H. B. HOMMON

Sanitary Engineer, U. S. Public Health Service, in Charge of Sanitation in the National Parks

THE Grand Canyon National Park, created by act of Congress, Feb. 26, 1919, is one of the 19 national parks administered by the National Park Service, under the Department of the Interior. It lies in the northern part of Arizona and has an area of 958 square miles. Within this area the Colorado River flows through 56 miles of gorge or canyon which is over a mile deep and 20 miles wide at the top in places. The park derived its name from this canyon. Most of the visitors to the park have, in the past, gone to the south rim, where there are hotels, stores, and an automobile camp. The data given in this paper refer to sewage disposal at the south rim. An extensive building and development program is now under way on the north rim, but up to the present time only a comparatively few people have ever visited the territory in the park to the north of the Colorado River.

Water Supply.—The water supply for the south rim, furnished by the Santa Fe R. R. Co., is ordinarily hauled in tank cars from Flagstaff, Ariz., a distance of about 100 miles. When this supply becomes low, water is obtained from Puro, Ariz., which is about 120 miles from the canyon. The cost of bringing in water from Flagstaff is $3.09 per 1,000 gal., and the amount delivered during the peak of the tourist season, when there are approximately 2,400 people in the park, averages about 100,000 gal. daily.

The only sources of water supplies in the territory around the south rim are (1) the San Francisco Mountains, about 52 miles away; (2) Bright Angel Creek, about 6 miles away and at about 5,000 ft. lower elevation; (3) some springs approximately 2 miles distant and about 3,500 ft. below the rim of the canyon; and (4) the Colorado River. No attempt has ever been made to develop either of the first two sources, on account of the cost, and the spring supply has been in litigation until recently. The Colorado River has not been considered as a source of supply on account of the high turbidity of the water throughout the year at the place where a pumping plant could be installed, and because of the expense of a 6-mile pipe line and the cost of raising the water approximately 5,000 ft.

Sewage Disposal.—When the Santa Fe R. R. Co. began extensive developments at the south rim, before the Grand Canyon National Park was created, a sewage treatment plant, consisting of septic tanks, contact filters, and pressure sand filter, was constructed to treat the sewage so that the effluent could be used for irrigating lawns and for boiler purposes. The effluent, however, was always putrescible, contained hydrogen sulphide and could not be used for irrigating lawns near the hotel, and it was not satisfactory for boiler purposes. There was also a decided odor in the vicinity of the plant. The laundry waste caused foaming in the boilers, and was bypassed around the treatment plant.

In 1924 the number of visitors to the park had increased to such an extent that it was necessary to make extensive improvements to the railroad terminal

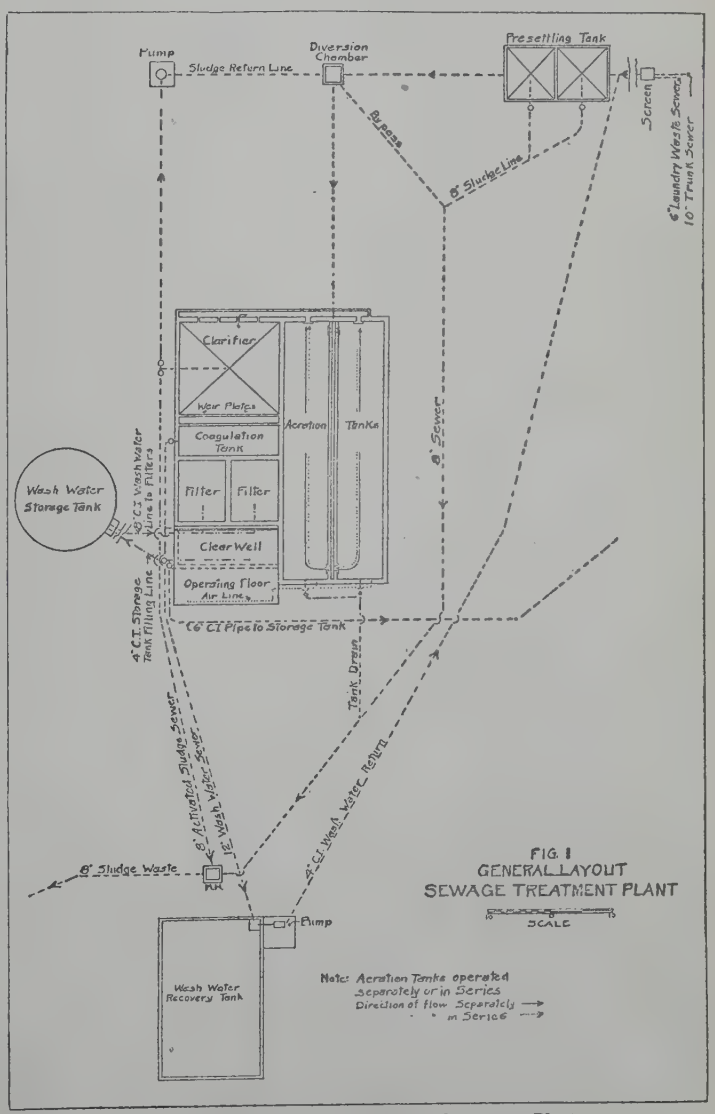

Fig. 1.—General Layout of Sewage Treatment Plant

Fig. 2.—General View of Sewage Treatment Plant. (1) Wash Water Return Line; (2) Presettling Tank; (3) Diversion Chamber; (4) Valve in Line From Air Channel; (5) Aeration tanks; (6) Clarifier; (7) House Over Sand Filters, Clear Well, Pumps and Motors

facilities, improve the roads, and adopt a comprehensive development plan for hotels, residences, stores, garages, etc., to take care of the visitors and employees. The problem of supplying water for the increased population was acute, and in the general plan worked out for major improvements there was included a new sewerage system and a sewage treatment plant that would purify the sewage so that it could be used for as many purposes as possible in place of fresh water.

On account of the troubles experienced in using the effluent from the old treatment plant in boilers, when the laundry waste was treated along with the domestic sewage, a separate sewer line was included in the design of the sewerage system to carry the laundry waste to the by-pass around the treatment plant.

Treatment Plant.—Since it was desired to purify the sewage so it could be used in place of fresh water, for certain purposes, methods of treatment were considered which would produce, consistently, the highest quality of effluent under the climatic and other conditions at the canyon. Settling tanks, slow sand filters, and sterilization would produce a satisfactory effluent, but the high cost of sand (approximately $7 per yard) and the difficulties of operation during the winter at an elevation of 6,800 ft., made this method impractical. Settling tanks, sprinkling filters, slow sand filters, and sterilization would also produce an effluent of the highest quality, but the high cost of materials and the severe winters precluded the adoption of this method. There remained, therefore, the activated sludge process, rapid sand filters, and sterilization as the method which could be operated with the least difficulties in the winter, which would produce throughout the year an effluent of the quality desired, and would require the smallest amount of material to be shipped to the canyon. In the following paragraphs there is given a description of the treatment devices installed. The layout of the plant is shown in Fig. 1, and a general view in Fig. 2.

Screen.—A coarse bar screen is located in a screen chamber on the trunk sewer line near the inlet to the presettling tank. It is 3 ft. wide by 3 ft. deep and has ⅜-in. by 2-in. rectangular iron bars spaced 2⅜-in. on centers. The bars are embedded in concrete at the top and bottom, and slope in the direction of flow of the sewage at an angle of 30°.

Presettling Tank.—Since it was essential that an effluent be obtained of the highest possible quality, and there was some uncertainty as to how the strong domestic sewage would react to the activated sludge treatment, it seemed advisable to install a presettling tank for the purpose of removing as much of the fresh fecal matter and other coarse material as practicable. The tank was designed for a detention period of 30 minutes at the time of maximum flow. It has hopper bottoms, and the sludge is discharged by gravity into the by-pass around the plant. The tank has two sewage outlet pipes, one of which is level with the top of the hoppers and leads to the aeration tanks while the other is near the top of the tank and connects with the lower pipe. This tank, as will be explained later, is also used to store a part of the night flow of sewage.

Diversion Chamber.—This is a small chamber located on the line from the presettling tank to the aeration tank for the purpose of by-passing the sewage, when necessary, around the treatment plant.

Aeration Tanks. — There are two tanks, each 42 ft. by 8 ft. by 10 ft. deep below the water level, and they were designed to treat approximately 200,000 gal. of sewage daily with an average aeration period of six hours. The design of the tanks is shown in Fig. 4. In each tank there are two continuous concrete air channels, each 42 ft. long by 11 in. wide by 5½ in. deep. Filtros plates, 12 in. by 12 in. by 1½ in. thick, were grouted into the top of the side walls of the channels, and into T-irons, 2½ in. by 1¼ in. and 2.87 lb. per foot, across the channels, as shown in Fig. 5. The air channels at both ends of the tanks have 4-in. pipes that extend through the concrete walls about 2 ft., and on the end of each pipe there is a 4-in. gate valve. These pipes and valves were installed for the purpose of cleaning out the air channels and to permit cleaning the under surfaces of the plates if they should become clogged. The air is applied to the 4-in. pipe at the ends of the tanks nearest the blowers, as shown in Fig. 3. At the opposite ends, 2-in. pipes connected to the 4-in. pipes between the valves and the tank walls lead upwards and over the walls into the tank. The 2-in. pipes were installed in order that the sewage which accumulates in the air channels when the plant is closed down can be blown up into the tanks instead of through the plates.

No difficulties were encountered in placing the filtros plates over the channels, and there has been no leakage of air around the plates. There was, however, leakage through a short section of one of the ridges of one tank when the plant was first placed in operation, but the leak was easily repaired.

The two tanks are separated by a wall that has at the top a channel which receives the raw sewage from the presettling tank. By means of a stop gate in the channel, the sewage is discharged into the end of one tank and flows out through an opening in the partition wall at the farther end into the other tank and through it to the effluent channel. If it is desired to use only one tank, the sewage is carried in the channel in the top of the partition wall to the farther end of the tanks where it is discharged into either tank and flows back to the effluent channel.

Clarifier.—This tank is 16 ft. square and 11½ ft. deep and is provided with a scraping device that concentrates the sludge at an outlet pipe in the center. It has a detention period of approximately 2.8 hours with the present flow of sewage, assuming that most of the sewage reaches the plant during 14 hours.

The effluent of the activated sludge tanks enters the clarifier through four openings spaced equally apart along one side and about 1 ft. below the surface of the sewage. The effluent flows out over a brass weir plate into a channel that leads to the end of a small secondary settling tank.

Secondary Settling Tank.—The secondary settling tank is 16 ft. by 4 ft. by 10 ft. deep, and was originally designed as a coagulation basin to be used in connection with the operation of the rapid sand filters. It was found, however, that it was not necessary to use

coagulants, and the tank has been used to settle the effluent from the clarifier. An appreciable amount of solids is removed by this tank, and the sludge is discharged through 1-in. openings spaced 1 ft. apart in an 8-in. pipe that extends the full length of the bottom of the tank.

Rapid Sand Filters.—Two filter units were designed, each having an area of 77 sq. ft. Concrete wash-water troughs were provided, and the underdrainage consists of 12-in. headers with 1¼-in. cast-iron laterals having ¼-in. holes bored on 3-in. centers. The specifications for the coarse sand and gravel were as follows:

8 in. gravel passing 2½-in. mesh screen and retained on 1½-in. mesh.
4 in. gravel passing 1½-in. mesh screen and retained on ¾-in. mesh.
4 in. gravel passing ¾-in. mesh screen and retained on ¼-in. mesh.
4 in. gravel passing ¼-in. mesh screen and retained on 1/12 in. mesh.

On account of the lack of data regarding the size of sand for rapid sand filters filtering sewage, there was ordered for filter No. 1 a sand having an effective size of 0.35 millimeters and a uniformity coefficient of 1.6, and for filter No. 2 a sand with an effective size of 0.40 millimeters and a uniformity coefficient of 1.6.

Although the sand and gravel delivered were marked in accordance with the specifications, it was found later, when difficulties were experienced in operating the filters, that the sand in filters No. 1 and No. 2 had effective sizes of 0.34 millimeters and 0.23 millimeters and uniformity coefficient of 1.29 and 1.48, respectively.

Loss of head gauges and rate controllers and other equipment were installed so that the filters could be operated in accordance with common practice in water-filtration plants.

Wash-Water Tank.—Water is delivered to the wash-water tank through a 4-in. pipe line connected to the reclaimed sewage force main, and the flow is regulated by an altitude valve. An 8-in. pipe supplies wash water for the filters.

Clear Well.—The clear well is 16 ft. square and 5½ ft. deep below the overflow. The capacity is 10,500 gal., but in practice the automatic floats start the pumps in operation when the sewage reaches about one foot below the overflow.

Pumping Equipment.—The reclaimed sewage is pumped to a steel storage tank by two 4-in. vertical centrifugal pumps which are operated by vertical motors. The tank sets level with the ground and has a capacity of 200,000 gal. The operation of the pumps is controlled by automatic float switches.

Blowers.—One air compressor with rotor revolving in water, which washes the air, was installed originally and a duplicate unit added a year later. The capacity of each of these units is 200 cu. ft. per minute.

Sterilizing Equipment.—A semiautomatic chlorine machine is used for applying liquid chlorine to the reclaimed sewage. When either of the pumps start operating, the force of the current in the main moves a vane hanging in the line, and this in turn opens a valve on the chlorine machine that permits chlorine dissolved in water to flow into the clear well at the combined suction of the pumps. When the pumps stop operating the vane falls back to a vertical position and shuts off the chlorine.

In addition to the liquid chlorine machine there is standard equipment for using sodium hypochlorite solution for sterilizing the filter effluents when for any reason liquid chlorine can not be applied. Sodium hypochlorite solution is kept on hand in 5-gal. jugs and everything is ready for use in an emergency.

Wash Water Recovery Tank.—Since every 1,000 gal. of reclaimed sewage that can be used in the place of fresh water is worth $3.09, a settling tank was installed to collect the wash water from the filters. This tank is 25 ft. by 16 ft. by 4½ ft., deep below the overflow. The capacity is 13,500 gal., and this is sufficient to store the wash water and permit it to be pumped back to the presettling tank at a low rate over a period of several hours.

Operation Data.—Sewage was turned into the treatment plant the latter part of June, 1926, and the effluent was pumped to the storage tank the next day. At first only one aeration tank was used and a fairly satisfactory floc developed within a few days. The floc did not settle out in the clarifier, however, and later there was trouble in keeping the floc down in the tank. As a result the filters clogged quickly. After two months a floc developed which settled in the clarifier, and since then there has been no trouble of a serious nature in operating the plant.

Much of the fine sand has been lost in washing the filters, and new sand has been ordered with an effective size of 0.40 millimeters and a uniformity coefficient of 1.6 for both filters. The coarser sand should give much higher rates.

In Table 1 there are given the more important data pertaining to the operation of the sand filters, aeration tanks, and sterilization of the filter effluent, from May, 1927, to March 31, 1928.

The only sewage lost is that mixed with the sludge drawn off from the presettling tank (600 gal. daily) and the activated sludge that accumulates in excess of the amount required for the operation of the aeration tanks. The total volume of activated sludge wasted per month on the average is about 20,000 gal.

From the first of May, 1927, to the end of November, 1927, 98.5 per cent of the sewage was reclaimed; and since December, the laundry waste amounting to 7,000 gal. daily during the winter and 10,000 gal. in the summer, has been mixed with the sewage and recovered.

As already stated the air supply lines connect with the four 42-ft. air channels under the filtros plates. When the blower is closed down, the sewage filters through the plates and fills the channels. When the air is turned on again, the valves on the 2-in. blow-out lines are opened and the sewage is blown through the pipes into the tank. By this method of operation no sewage is forced back through the plates. The sewage can be blown back through the plates, however, and this has been done frequently. It requires less than one minute to free the channels of sewage after the air pressure is turned into them. The initial air pressure on the channels was 5 lb. per square inch; and after operation of the plant for almost two years, it is only 5½ lb.

The average amount of air used, approximately 4.6 cu. ft. per gallon, for the period covering 11 months, was no doubt more than was required, but it was the normal output of the blower and there would have been no economy in reducing the volume. The aeration period, about 11½ hours, was longer than necessary to produce a satisfactory floc and stable effluent, but the

Table 1.—Data Pertaining to Operation of Sand Filters, Aeration Tanks and Sterilization[1]

Month, 1927-28	Net rate m.g.a.d. for Filter No. —[2] 1	2	Per cent wash water Filter No. — 1	2	Period between washings (hours) Filter No. — 1	2	Flow raw sewage, 1,000 gallons	Reclaimed sewage, 1,000 gallons	Amount of air used per gallon, each tank	Aeration period, hours each tank	Chlorine parts per million Added	Residual at plant
May	20.6	20.6	3.7	3.5	32	32	73	[3]72	....	....	3.6	0.4
June	23.0	23.0	3.4	3.8	50	32	83	81	2.1	5.5	3.6	.4
July	23.9	23.9	2.8	5 0	63	36	85	84	2.0	5.3	3.6	.5
August	24.4	24.4	3.3	3.8	68	53	88	86	2.1	5.1	3.2	.4
September	23.5	23.5	3.5	3.9	64	59	83	82	2.2	5.5	3.7	.5
October	21.0	21.0	3.8	4.2	50	41	75	74	3.0	6.1	4.0	.4
November	22.2	22.2	2.3	2.1	54	59	80	78	2.2	5.6	3.5	.5
December	21.1	21.1	3.8	4 1	47	44	76	75	2.5	6.0	2.7	.5
January	20.5	20.0	2.8	2.5	47	51	73	72	2.4	6.1	2.6	.5
February	21.6	21.6	3.7	3.3	38	39	77	76	2.4	5.8	1.9	.5
March	21.9	21.9	3.3	2.8	49	57	77	76	2.1	5.8	2.3	.5

[1]The figures in the table represent averages of daily records.
[2]Sand practically same size in both filters. This is due to returning to the filters sand lost in washing.
[3]Volume of reclaimed sewage was obtained by meter on force main; that of raw sewage by computation.

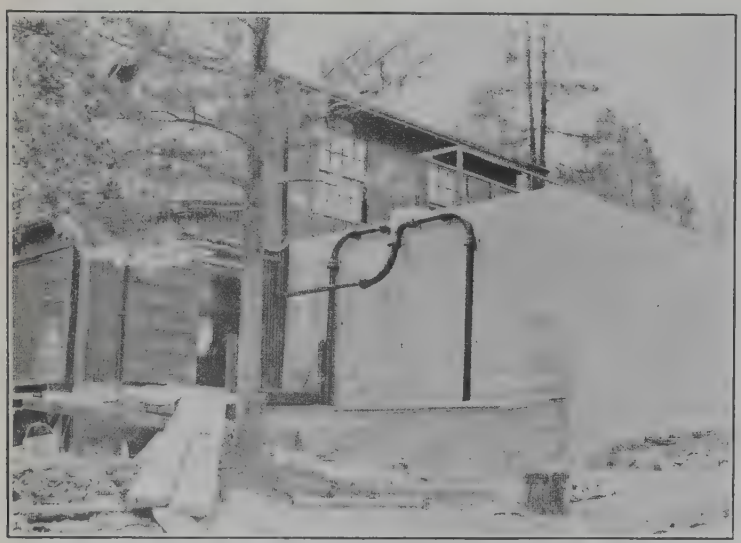

Fig. 3.—Air Supply Pipe to Channels Under Filtros Plates

tank capacity was available and it seemed advisable to use it. It is believed that the present tanks and one blower will treat twice the volume of sewage now received at the plant.

An excess of about 0.5 parts per million of free chlorine has been carried in the force main at all times to insure complete sterilization of the reclaimed sewage in the storage tank.

There is an operator in charge of the plant from 7 in the morning until 10 at night. Just before 10 p. m. the sewage in the presettling tank is drawn down to the hoppers and the sludge wasted, and the clear well is pumped out. The blower and aeration tanks operate throughout the night, but generally there is not enough sewage flowing between 10 p. m. and 7 a. m. to fill the presettling tank and clear well. This method of operating the plant has proved entirely satisfactory and saves the labor of one man.

The aeration tanks give most satisfactory results when they contain about 25 per cent of activated sludge. Sludge is returned from the clarifier to the diversion chamber ahead of the aeration tanks by an air lift.

Chemical Analyses.—A complete chemical laboratory was installed in April, 1927. The monthly average results of analyses of sewage and effluents for 11 months are given in Table II.

In comparison with the averages of results given in Public Health Bulletin No. 132, "Sewage Treatment in the United States," the settleable solids, suspended matter, and oxygen demand results of analyses of raw sewage at the canyon were, respectively, 278, 23, and 232 per cent stronger than the averages for the 15 cities given in the Bulletin. The suspended matter in the sand filter effluent at the canyon was consistently below five parts per million, the nitrates were high, and the oxygen demand was below two parts per million. The oxygen demand of the effluents of the aeration tanks and clarifier was likewise uniformly less than two parts per million. The dissolved oxygen was low; and this is explained in part by the fact that at the elevation of the treatment plant (6,866 feet) the solubility of oxygen in water is about 30 per cent less than at sea level. The relative stability of the effluents from the filters and clarifier by the methylene blue test was in every analysis more than 90 per cent.

There is practically no permanent hardness in the sewage at the canyon, and up to the time the laundry waste was treated at the plant, December, 1927, the average of 185 determinations of alkalinity was 190 parts per million, and for the same number of analyses of the effluent of the clarifier and the sand filters, the averages were, respectively, 29 and 27 parts per million. The effect of the laundry waste on the effluent is discussed later in this paper.

In Public Health Bulletin No. 132, page 13, Table No. 6, there are given the changes in the alkalinity of different sewages on passing through oxidizing devices. The sprinkling filters at Fitchburg reduced the alkalinity from 99 to 8 parts per million; those at Baltimore, 144 to 63; Reading, Pa., 177 to 105; Rochester (Brighton plant), 189 to 131; Lexington, 194 to 152; Atlanta (Intrenchment Creek plant), 82 to 48; Atlanta (Peachtree plant), 69 to 35; and Columbus, 219 to 192. The contact filters at Alliance reduced the alkalinity from 194 to 167, while similar filters at Canton showed an increase of 11 parts per million. The activated sludge plant at Houston (south side) reduced the alkalinity from 304 to 220, and the north side plant, 270 to 198; at San Marcos, Tex., the reduction was from 311 to 239; and at Sherman, Tex., the alkalinity of the effluent was 416, and of the sewage, 415. The reduction of the alkalinity in each plant was almost directly in proportion to the degree of purification effected. At Fitchburg, for example, where 92 per cent of the alkalinity of the sewage was removed by the sprinkling filters, the nitrification was higher and the oxygen demand lower than at any of the other filter plants. The effluent from the activated sludge plant at Sherman, Tex., which was the poorest of all the effluents examined from activated sludge plants, had practically the same alkalinity as the raw sewage. The plant at the Grand Canyon removed 86 per cent of the alkalinity before the laundry waste was treated with the sewage, and 80 per cent afterwards.

In view of the fact that the oxidizing processes of sewage-treatment plants, when producing a high quality of effluent, reduce the alkalinity somewhat in proportion to the extent of oxidation

Table II.—Monthly Average Results of Analyses of Sewage and Effluents[1]

Month, 1927-28	Suspended matter, parts per million			Settleable solids, c. c. per liter, 1 hour		Nitrogen in clear well as—			Dissolved oxygen, parts per million (clear well)	Oxygen demand (5 day), parts per million				Relative stability by methylene blue test (per cent)		Alkalinity as $CaCO_3$ by M. O., parts per million		
	R	C	CW	R	C	NH_3	NO_2	NO_3		R	AS	C	CW	CW	C	R	C	CW
1927																		
May	259	.....	4.3	12.0	Tr.	0.56	.....	5.6	3.2	.....	.....	.....	1.8	90+	90+	185	....	24
June	244	6.0	3.5	9.1	Tr.	.60	0.33	7.3	3.3	366	0.8	1.5	1.7	90+	90+	169	19	20
July	283	9.0	3.3	13.0	Tr.	.50	.70	5.8	4.1	487	1.3	1.9	1.6	90+	90+	187	27	24
August	292	6.0	3.0	10.0	Tr.	.53	.90	4.5	3.8	437	1.6	1.7	1.6	90+	90+	191	39	37
September	211	8.0	3.0	9.0	Tr.	.54	.77	3.0	4.0	380	1.1	1.3	1.0	90+	90+	209	38	34
October	225	5.0	3.0	11.0	Tr.	.45	.63	4.9	4.4	406	1.3	1.5	1.3	90+	90+	217	22	20
November	210	5.0	3.0	7.5	Tr.	.60	1.40	4.4	5.0	390	1.1	1.4	1.4	90+	90+	176	30	28
December	214	6.0	3.0	9.7	Tr.	.63	1.00	4.8	5.0	420	1.1	1.3	1.1	90+	90+	163	51	48
1928																		
January	201	10.0	5.0	10.0	Tr.	.58	.38	7.0	4.7	403	2.5	2.7	2.3	90+	90+	166	50	51
February	193	7.3	3.4	12.0	Tr.	.62	.32	7.0	4.5	388	1.6	1.7	1.6	90+	90+	172	87	86
March	207	7.0	4.0	11.0	Tr.	.39	.48	7.1	4.8	351	1.6	1.7	1.6	90+	90+	204	81	81
N	127	119	124	289	210	87	68	87	284	52	51	52	279	307	306	296	268	296

[1]Composite samples.

Note.—R = Raw sewage; C = Clarifier; CW = Clear well; AS = Activated sludge tank effluent after settling 30 minutes; N = Number analyses made.

of the organic matter, it is but reasonable to assume that the reduction is associated with the biological activity of the oxidizing devices. This relation, if better understood, might possibly throw more light on the problem of sewage treatment.

The pH value of the raw sewage and activated sludge at the canyon averages 7.0, and the final effluent, 6.3.

Bacteriological Results.—Routine bacteriological analyses have been made weekly at the treatment plant since Jan. 1, 1928. A summary of the results is given in Table III.

The results given in the table show that 99.98 per cent of the bacteria in sewage growing on agar, 24 hours, 37° C., were removed by the treatment plant, and that 99.84 per cent of the *B. coli* in the raw sewage were removed by the aeration tanks and clarifier, and 99.99 per cent by the plant as a whole. Out of the 70 portions of 10-cubic-centimeter samples of the sterilized effluent analyzed, only one was positive for *B. coli.*

Before the bacteriological work was started at the plant, 41 samples of the reclaimed sewage were sent to the Arizona State Board of Health for analysis. Of these, 28 were taken from the force main to the storage tank. The analyses showed that only five of the one hundred and forty 10-cubic-centimeter portions were positive for *B. coli*, and all these portions were from one sample. Thirteen samples were taken from a tap on the reclaimed sewage distribution line in the power house. In one sample all five 10-cubic-centimeter portions were positive for *B. coli*, and in one other sample one portion was positive. All other results were negative.

Since June, 1926, there has been made a total of 55 analyses of samples of the sterilized effluent collected from the force main to the storage tank and from a tap in the claimed sewage line in the power house, and five portions of 10 cubic centimeters each were analyzed from each sample. There were, therefore, 275 portions tested. Of these portions, 12, or 4.4 per cent, were positive for *B. coli.* It is believed that these results represent the average quality of the effluent for the entire time the treatment plant has been operated.

Table III.—Summary of Bacteriological Analyses
(Period covered by analyses, Jan. 1 to Mar. 31, 1928)

Total Count on Agar, 24 Hours, 37°C.	
Raw sewage, average 14 analyses	810,000
Aeration tank, average 4 analyses	28,000
Effluent sand filters, average 14 analyses	103
Sterilized effluent in force main, average 14 analyses	2
B. Coli	
(1) Raw sewage:	
Number per c.c., average 14 analyses	220,000
Number samples having 1,000 per c.c.	1
Number samples having 10,000 per c.c.	11
Number samples having 100,000 per c.c.	2
(2) Effluent, clarifier:	
Number samples having less than 100 per c.c.	1
Number samples having 100 per c.c.	10
Number samples having 1,000 per c.c.	4
(3) Effluent, sand filters:	
Number samples having less than 1 per c.c.	8
Number samples having 1 per c.c.	6
(4) Sterilized effluent delivered to storage tank:	
Number 10 c.c. portions tested	70
Number 10 c.c. portions negative	69

Table IV

	Raw waste	Treated waste
Oxygen demand, five days, parts per million	97	25
Suspended matter, parts per million	221	12
Total solids, parts per million	1,061	864
Alkalinity, parts per million	249	50
Phenol alkalinity, parts per million	7	0
Noncarbonate hardness, parts per million	0	0

Recovery of Laundry Wastes.—After the treatment plant had been in operation for a few months and was producing a satisfactory effluent, an investigation was made to determine how the laundry waste could be treated so that it could be recovered along with the sewage and not interfere with the use of the reclaimed sewage for generating steam. The investigation included chemical precipitation using alum in amounts varying from 10 to 35 grains per gallon. The smallest amount of alum giving satisfactory results was 15 grains per gallon. The averages of the analyses of the compositite waste untreated and treated with 15 grains per gallon are given in Table IV.

The reduction of the alkalinity from 249 to 50 parts per million by using 15 grains of alum per gallon is not in accordance with the reduction found in water treatment plants. The only explanation that can be offered for the reduction of 13 parts per million per grain of alum used is that the untreated laundry waste contained in suspension insoluble precipitates which reacted with the acid of the standard solution, whereas with the treated samples only the clear supernatant fluid which was free of suspended matter, was titrated.

Since the analyses showed that the hardness of the laundry waste was due to carbonates and bicarbonates, and 86 per cent of these constituents was removed from the sewage in the treatment plant, it was not considered necessary to treat the waste. It was mixed with the sewage and treated at the plant beginning December, 1927. The total hardness of the combined sewage and waste after treatment was determined hourly by the soap method for eight days during the hours the waste was passing through the plant. The analyses varied from a minimum of 23 to a maximum of 37 parts per million, with an average of 34. This average is slightly above that for the treated sewage before the waste was added. The monthly average results of soap hardness of the final effluent for January, February, and March were, respectively, 24, 38, and 47 parts per million, while the alkalinity results for the final effluent for the three months were 56, 86, and 81. The higher results for alkalinity were due to the presence in the laundry waste of sodium carbonate, which effects the alkalinity but not the soap hardness.

The suspended matter in the laundry waste was about the same as that in the raw sewage and the oxygen demand about one-fourth.

With the recovery of the laundry waste the amount of reclaimed sewage approaches very closely to 99 per cent of all the water discharged into the sewers.

Uses of the Reclaimed Sewage.—At the present time the reclaimed sewage is used in stationary boilers for generating steam for heating purposes, and in the locomotives that haul passengers and freight trains on the branch line of the Santa Fe from Williams to the canyon; for cooling water for Diesel engines; for irrigating lawns around the hotel; and for flushing toilets in the public comfort stations in the El Tovar Hotel, Bright Angel Camp, railroad depot and the Government automobile camp.

The force main from the treatment plant runs direct to the storage tank with only one branch taken off to supply cooling water for Diesel engines. The entire distribution system from the storage tank is inclosed in vitrified pipes up to the outlets or fixtures where the reclaimed sewage is used. Beyond the vitrified pipe the uncovered distribution lines are painted red. The sewer pipe will prevent cross connections to fresh water lines. The pressure on the fresh water mains is greater than that on the reclaimed sewage lines. No valves, spigots, or any other openings are permitted on reclaimed sewage lines except where absolutely necessary. Accurate maps are kept up to date showing all the fresh water and reclaimed sewage pipe lines and no extensions or alterations of either piping system can be made without the approval of the superintendent of the park. With these limitations and precautions in distributing the reclaimed sewage, and the careful supervision given to the operation of the treatment plant, it is believed that it will be possible to use the reclaimed sewage indefinitely without any danger to the health of visitors to the park or of employees.

There has been no criticism by employees at the canyon who use the reclaimed sewage for generating steam or for any other purposes. The locomotive engineers vigorously opposed the use of "sewage" in passenger engines at first, but after demonstration by an expert engineer they used the reclaimed sewage and found that it produced less scale than the fresh water obtained at the canyon.

All the reclaimed sewage is now being used for the purposes named above, and no others will be permitted, except possibly the washing of automobiles, under certain restrictions.

The treatment plant is operated un-

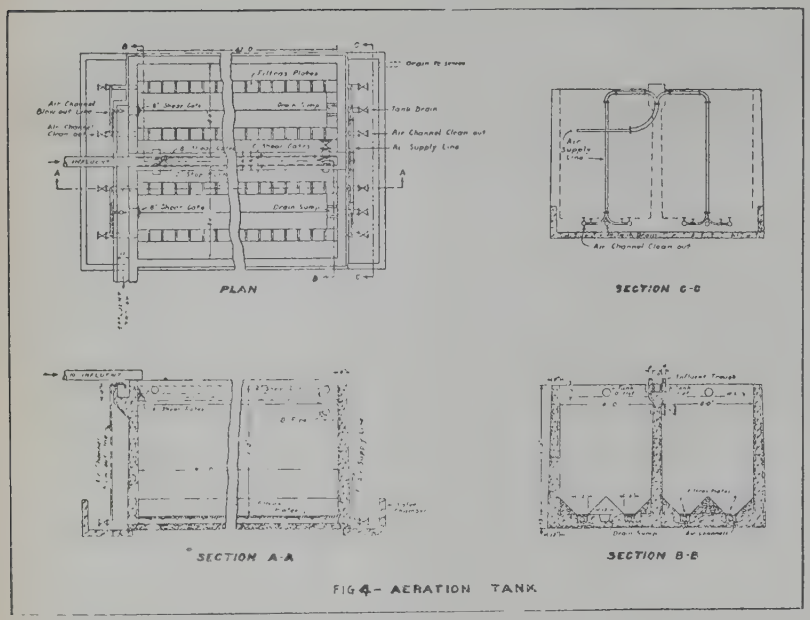

Fig. 4.—Aeration Tank

der the supervision of a competent sanitary engineer who has two trained assistants.

Cost of Operation.—In considering the cost of operation, the fact should be kept in mind that the plant was designed and is operated to produce an effluent of the same degree of purity from a bacteriological standpoint as drinking water, and that every 1,000 gal. of reclaimed sewage that can be used in place of fresh water is worth $3.09. The cost data, therefore, should be considered in relation to water filtration rather than sewage disposal.

The average volume of sewage reclaimed daily during 1927 was 79,000 gal., and the itemized cost of treatment per 1,000 gal., was approximately as follows:

Electric current at 5 ct. per kilowatt:	
Operating blower	$0.20
Returning wash water	.003
Operating clarifier	.01
Lighting	.003
Labor for operating plant:	
2 operators and sanitary engineer	.177
Liquid chlorine, oil, grease, repairs to equipment, and extra labor	.009
Interest on investment[1] (treatment plant only)	.086
Depreciation[1] (treatment plant only)	.086
	.574

These costs would be reduced approximately one-half if the plant were operating at the capacity for which it was designed and if electric current were available at the commercial rate charged in cities; and the labor cost would decrease materially for plants treating large volumes of sewage.

Conclusions.—The experience at the canyon has proved that it is possible to produce, continuously, a sewage effluent of the same quality as drinking water, in so far as bacteriological results are concerned, and of better quality than the original water for generating steam.

It is believed that where there is a scarcity of water, particularly in the West and Southwest, it will be economically practicable to reclaim sewage for industrial purposes, and for irrigating any kind of crops without danger of contaminating ground water or the products grown. The same degree of purification, however, will not be required for sewage to be used for irrigation as for industrial purposes, but sterilization will be necessary for reclaimed sewage used in growing vegetables and some other crops. The cost per acre-foot for sterilizing a well-oxidized effluent such as that produced by an activated sludge plant will be approximately $1.20 for small treatment plants using small cylinders of chlorine, and $0.60 for large plants using one-ton containers. The cost for operation of treatment plants will depend on the volume of sewage treated and the prices for labor and materials and for electric current where the activated sludge process is used. Where sewage is reclaimed for industrial purposes or for irrigation, a part of the operating expenses should logically be charged against the municipalities for disposal of the sewage, and the remainder paid by the parties benefiting by the use of the reclaimed sewage.

No municipality or private corporation should attempt to design a treatment plant to reclaim sewage without the assistance of a competent sanitary engineer, and every plant constructed should be under the supervision of a competent operator.

The treatment plant was designed by the writer, assisted by L. D. Mars, formerly assistant sanitary engineer, United States Public Health Service; M. R. Tillotson, formerly civil engineer of the park and now superintendent; and G. L. Davenport, assistant engineer, Santa Fe Railroad Co. The plant was built jointly by the Government and the Santa Fe Railroad Co. Mr. J. R. Eakin, formerly superintendent of the park, had general supervision over the part built by the Government, with Mr. Tillotson in active charge of construction, and the work done by the Santa Fe was under the general supervision of R. B. Ball, chief engineer coast lines, and G. L. Davenport, assistant engineer.

The plant was operated for one month at the start by Frank R. Shaw, associate sanitary engineer, United States Public Health Service, and he was succeded by Dario Travaini, who is now in charge and who supplied the chemical and bacteriological analyses given in the tables.

Acknowledgment.—The above article is taken from the Oct. 5 issue of Public Health Report.

Beccari Garbage Disposal System for Florida City.—The city of Dunedin, Fla., has contracted for the installation of a garbage disposal system of the Beccari type.

Toledo's Airport. — The Municipal airport of Toledo, O., has an area of 225 acres. The transcontinental airport located south of the city has an area of 560 acres.

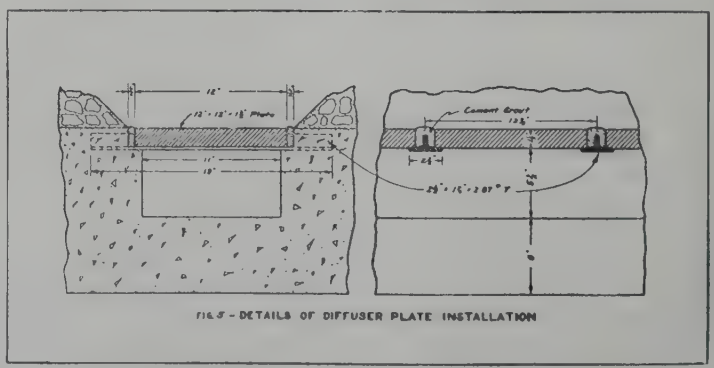

Fig. 5.- Details of Diffuser Plate Installation

[1]Estimates, but believed correct within 2 ct. per 1,000 gal.

The American Engineering Councils' Report on Traffic Signals

Interesting Comments on the Recently Issued Report

By GUY KELCEY

Manager, Traffic Engineering Division, American Gas Accumulator Co., Elizabeth, N. J.

IN the invitation which was extended to me to speak at this meeting, it was requested that I offer appropriate comments on the American Engineering Council's Report on Traffic Signals.

I find myself in the very difficult position of discussing this report before it has been presented and without having had an opportunity to ascertain clearly just what changes have been made in the tentative draft upon which my discussion is based. I shall, therefore, proceed on the assumption that the tentative report has been adopted in the final draft, except for such modifications as have been called to my attention during the past few days.

Good Work of Committee.—The committee has organized and clarified much that has been confusing to traffic officials. Within the range of present traffic experience and knowledge, this committee has done most excellent work and their effort will be of great value to the traffic official and to the manufacturers of traffic devices, who, by the way, are distracted by the great variety of demands for special equipment which does not fit in a quantity production program.

The time for this discussion is limited, so, while much should be said in praise of the conclusions of the report, it would seem more constructive to confine my remarks to those aspects of the report which may possibly be confusing to traffic officials or which may later be subject to modification.

The United States has gone in for standardization to a greater extent than other nations. Our urge to standardize arises principally out of several motives. There is the standardization of intolerance and of the fixed idea. There is the standardization of habit, to which we all conform to avoid being unconventional. Again, standardization of production which permits the manufacture of many identical articles with the advantage of low cost, ease and economy of repair, maintenance and replacement. Finally, there is the uniformity expressed by the standardization of road signs which, like the alphabet, enables us all to read the same message at a glance, just as we all read the same language.

Opportunities of Standardization for Good or Evil.—Before proceeding to the details of the report, it is proper at this point to mention that standardization has opportunities for both good and evil. If standardization is overdone, or if it be premature, it can easily close the door on improvement and on invention. Again, it is not easy to standardize without taking into consideration all conditions, because the scope of any one man's experience in traffic work cannot comprehend all conditions. This may be illustrated by the many attempts at standardization of traffic practice during the past eight years. A highway official with mountains to contend with has an entirely different idea of a curve, turn or grade than a highway official in a prairie state. The narrow, winding streets of New England towns present an entirely different problem than the wide, straight streets of some western cities. No one who has not had to take the responsibility for the solution of multiple intersection problems, such as are to be found in the six point intersections of Indianapolis and Chicago, can have a very sound judgment of what may or may not be used in their treatment. The driving habits and abilities of motorists in South Carolina, Wisconsin and New Jersey are surprisingly different. So condition after condition varies from one jurisdiction to the next, and so, likewise, does the point of view of what is the proper treatment and the proper standard. As a result, we have had a great number of standardizing bodies or groups in different parts of the country, whose conclusions are sound within the range of their limited experience. We have also had a tremendous pressure to standardize on pet ideas from a considerable group of persons who make traffic an avocation and not a business and whose real experience is in question.

It seems proper to say, therefore, that standardization will be attained in actual practice only when the combined experience of men with a great variety of local traffic problems is added to the experience and ability of highway officials who drive thousands of miles a year over every conceivable kind of road, whether it be the shell roads of Louisiana, the gravel roads in Wisconsin, the mud roads of other states; the long, high speed stretches of concrete, or narrow, winding, mountainous highways of our eastern and western states. Until these conditions are reconciled, national standardization is not possible because any standard adopted, which does not fit, will not be used in practice.

The American Engineering Council, in its present effort, has probably gone as far as it is possible at present to combine in the personnel of its committee as wide an experience as possible, but their effort will have permanent value only insofar as the investigations and study of this committee are expanded and continued and the standards code, which is here presented, modified and improved in terms of changing conditions and experience.

Standard Highway Signs.—For a number of years the American Association of State Highway Officials and the Bureau of Public Roads have combined their best experience to formulate and produce a set of standard signs. This standard suits the highway problem; whether in mountainous or flat country, or on mud or concrete roads. The American Engineering Council Committee, in its report, recognizes and adopts this standard with some modification. Under the standard referred to, a sign 24 in. on a side, and used as a square or diamond, constitutes the backbone of the system of signs. Used as a square, the horizontal dimension is 24 in., and as a diamond the horizontal dimension becomes 34 in. There are many towns and cities where the streets are so narrow and where there is so little sidewalk space that, if this diamond sign is installed, it will absorb much and, in some cases, all of the usable sidewalk width. In addition, the points of this sign are dangerous to pedestrians, and particularly to running children. This standard is perfectly adapted to highway practice but, unless the same type of sign can be used in cities and towns, the system can hardly become a national standard. In this instance, highway officials, thinking only of highway problems, adopted a most excellent standard for their use. Many municipalities cannot use it effectively, and it cannot, therefore, become a universal standard without modification. This modification the Committee of the American Engineering Council has seen fit to make, by reducing the dimension to 18 in. instead of 24 in. This modification is still probably not enough. It should be required that the points of the sign used as a diamond be rounded off to safeguard pedestrians and children. Since town signs must present as little horizontal width as possible, it is desirable that the diamond shaped sign, which presents a maximum horizontal dimen-

sion, be used as little as possible or not at all, and, if the shape standard could be changed, it is highly desirable that the diamond sign be eliminated where narrow streets are involved. The problem could be met by installing all such signs at an elevation of 8 ft.

Street Traffic Signs.—Under Section 1 on "Street Traffic Signs" appears a list of eight traffic requirements, which are designated by various shapes and dimensions. All these requirements reduce to three—prohibition, limitation or information. A diamond shaped sign, which indicates a condition inherent in the roadway itself, is specified for "Slow," and a square sign, which warns of a condition not inherent in the road, is to be used for "Caution." One wonders if the average traffic official will know where to use a "Slow" sign and where to use a "Caution" sign, and if, after he has made his decision, the public will know the difference. For practical purposes, are not "Slow" and "Caution" the same thing to the average driver? If so, a driver will react the same to either one, and why should one be designated by a diamond and the other by a square sign? This illustration is used to suggest that distinctions can be too finely drawn for the average driver's comprehension and that efforts at standardization should aim to simplify. It is hoped that your committee has in mind the ultimate simplification of the various designations, which, in the end, can express no more than "Stop" or prohibition, "Caution" or limitation, and finally, information.

The committee's report urges the adoption of a stop sign with a red lettering "Stop," and points to the advantage of being able to eliminate the red lettering. It is urged that the committee reconsider this action, since much, if not most, of the stop sign work of the future will be done with reflecting material, which, under the influence of atuomobile headlights, will cause the word "Stop" on the sign to stand out brilliantly to the driver at night. To produce a color with light, it is necessary to screen out or take away part of the light, and that which is left is the color required. To produce red, 60 per cent of the light is lost and 40 per cent is used. Under actual road test, one make of reflector stop sign with red letters was just readable at night under driving conditions at 121 ft. and with white reflecting letters of the same material at 215 ft. To produce, therefore, red lettering, it is necessary to sacrifice so much visibility at night that the standard which requires the luminous part red is of questionable benefit. The committee's decision to use a yellow background and a red lettering for a stop sign would appear to be sound since, in the proper interpretation of colors, red indicates "Stop" and yellow "Caution." It is suggested for the committee's consideration that so much is to be gained by having luminous or illuminated lettering on a stop sign white; that this should be permitted, and that the reflector lettering "Stop" be bordered with red, thus satisfying the requirement that red be used.

Height and Location of Movable Posts.—Attention is called to requirement No. 2, entitled, "Height and Location of Movable Posts on Roadway," in which it is suggested that the center of the sign be 4 ft. above the pavement. Immediately following this recommendation, it is suggested that if reflecting signs are used, they shall be 3 ft. above the pavement. This would appear to be reversed, since an ordinary non-luminous sign must be down in the range of headlights to be seen, and, therefore, centered at 3 ft. above the pavement, while a reflecting sign collects enough stray light anywhere up to 8 ft. above the pavement to render the reflecting units brilliantly luminous under the headlights. A non-luminous sign should never be placed above the headlight range; while a reflecting sign is effective even though above the headlight range, and, therefore, may be so placed.

Comments on Stop Signs.—The section of the report on stop signs invites several further comments.

In Paragraph 4, under Rule 10, it is indicated that "A stop sign shall be placed at a point where the message is to be obeyed. At intersecting streets, this point is on the property line of the side protected street." This recommendation is open to some queston. The property line in some instances is so far back from the curb line of the through street that vision is obscured by foliage, street light, telegraph and other poles. From such position, traffic on the through street cannot readily be seen. If this rule should be adopted the careful driver would stop at the property line, where the law requires, and would stop again near the curb line, where he can see the traffic he has to cross. Under this rule, if he is not a careful driver, he will cause accidents. It is suggested for consideration, that this rule be revised, and that traffic be required to stop where the best visibility of the intersected street can be obtained, and that a stop line be painted on the pavement at this point.

The committee is to be commended upon its adoption of the sign wording "Stop, Through Traffic." There are approximately sixteen different variations of the wording "Through Traffic Stop," such as "Boulevard Stop," "Through Highway Stop," and more recently Massachusetts' proposal of "Through Way Stop." After all, whether it is a way, a highway, a boulevard, or an avenue, the reason for stopping is "Through Traffic." The expression "Stop Through Traffic" fits every case, and combines the sixteen variations into one which is universal.

Under Rule 16—"Slow Signs," it is recommended that the word "Slow" be in 2-in. letters when used with "Hill" and other similar designations. A 2-in. letter, to a person with normal eyesight, is readable at 125 ft. in daylight; and at 10 ft. under headlights at night. Restated in terms of time, this means four seconds at 20 miles per hour during daylight. At night it is of no value. It is a question if the word "Slow" has any value on a sign if it is put in 2-in. letters. The question also arises if the words "Hill," "Cross Street," etc., need to be supplemented by an insignificant word "Slow" when it helps to confuse the main message and when the main message tells the whole story.

Stop and Go Signals.—Under "Street Traffic Control Signals"—Section 2, it is suggested that stop and go signals should not be operated at times when the volume of traffic is reduced. A stop and go signal is usually placed at a difficult corner. As the volume of traffic decreases, the speed increases. Many traffic officials have found it expedient and of great benefit when the normal operation of the signal is discontiuued, to operate the amber as a flashing light. This is suggested for consideration by the committee.

The use of two or three colors for stop and go signals is a question of controversy, a limited number of cities and towns having adopted the two-color. The great predominance of opinion seems to favor the three-color. Under the circumstances, the advisability of mentioning the two-color at all in a standard of this kind is doubtful. If, in the investigations made by the committee, the subject is so obviously in doubt and not definitely clear, all reference in the standard to the use of either two or three colors might well be left out, for the reason that the publication of it in the standard will cause much confusion. In my own experience, the use of amber after green is not only finding increasing favor, but perfectly fits the traffic need. On the contrary, the use of the two-color signal or the amber after both green and red leaves much to be desired.

Signal Specifications.—Under "Signal Specifications"—Rule 60, Item 2, a 60-watt capacity lamp has been specified as standard. Sixty-watt lamps in some signals which have been installed give an indication that is so poor that the signal is a hazard rather than a safeguard. In other signals, the indication is good. Any standard set up around the matter of lamps or optics used in a signal should be in terms of the intensity and distribution of the signal indication. As a matter of fact, it is the signal indication to the driver with which we are actually concerned. Properly used, a 25-watt lamp can be made to give a far better indication to the driver than a 60 or 100-watt lamp improperly used. This leads to the

point that a highly desirable standard which should be adopted as early as possible, should concern itself not with the kind or size of lamp, but should establish a minimum requirement for light distribution and intensity of signal indication to the driver and to the pedestrian.

It is very gratifying to know that the committee has seen fit to re-comment against words on signal lenses. One is always reminded of the milk wagon horse in Stamford that shied at a cat one morning at 4:30 and ran away. Two blocks down the street he came to a stop and go signal that switched from green to red, and the horse stopped. They vouch for this story in Stamford, and, if it is true, it indicates that horses know what red, yellow and green mean, and humans ought to. This has been a troublesome point for years.

The committee expresses the thought that only one type of signal installation should be used in each city. I should like to register my opinion that, to attain such standardization, sacrifices efficiency of treatment for many locations. If the signal is a good signal and properly designed, it will find traffic and compel attention and drivers will not have to hunt for it. In my opinion, a good signal may be placed in a variety of positions on a corner to advantage. It is suggested that the requirements for standardization of location should be that the signal or signals shall be visible to the traffic approaching from any direction.

Height of Signal.—Under the "Height of Signal," the Report states that experience indicates that the bottom of the housing should be 4 ft. to 8 ft. above the pavement if the signal is inside the curb line. This conclusion is open to question, because at any height under 8 ft. the signal is likely to be obscured by parked, stopped or moving vehicles.

The report leaves one with the strong impression that obstructions, such as various types of signals and mushroom buttons in the street, are not considered with favor. I offer as my own opinion that one of the greatest difficulties with traffic arises out of irregular movements of vehicles at intersections. These irregular movements can be prevented without interfering with the proper operation of vehicles, expediting the movement of traffic and reducing accidents. Safety zones and refuges in the throats of streets are in many cases very valuable for such work.

Railroad Crossing Gates.—Rule 79—"Railroad Crossing Gates." There is a considerable problem here since railroad crossing gates are usually lighted by a small red light or lantern that appears to be so much like a tail light that drivers pass around it to the left. For this reason, most gates are broken to the left of the light. Some standard night marking and illumination should be provided for railroad crossing gates which will eliminate this difficulty.

On the subject of railroads, there are many railroad, track circuit operated, train approach signals in the roadway on streets and highways, that give an indication only when a train is approaching and constitute a real menace to vehicles at night. It is urged that a standard be adopted requiring that all such signals located in the used portion of the roadway should be equipped with a flashing amber light to operate at all times when the train approaching signal is not being given.

We hear a great deal from railroad men about vehicles running into the side of trains. Those of us who drive 20,000 to 30,000 miles a year are well aware of this situation. Again and again one pulls up just in time to avoid running into a freight train standing or moving across the road, which so blends into the background landscape, that it is not visible to the driver, and this is particularly true on rainy nights. Something should be required to render freight cars, particularly on long trains, visible at night.

In the Report, the expression "wide" as distinguished from "narrow" streets is used in a number of places without exact definition. A street which would be considered wide and suitably straight in Marblehead, Mass., would be called narrow and winding in Atlanta, and a wide street in Atlanta would be called narrow by the City Engineer of Minneapolis. Narrow and wide streets should, therefore, be exactly defined.

Safety Zones.—In Rule 84, under the subject "Protection of Safety Zones," several suggestions are offered for the consideration of the Committee. The traffic approach ends of safety zones should be parabolic in shape. When this shape is used, a vehicle striking the zone is deflected. When any other shape is used the vehicle is stopped abruptly.

In connection with safety zones, the report suggests that posts be used to safeguard the zone. This, in my judgment, is a dangerous practice, because a vehicle colliding with such a safety zone will usually strike a post with the left side of the machine, and the force of the movement of the vehicle will swing it into the safety area, and not deflect it away from the zone. Again a red signal is recommended for the traffic approach end of the safety zone. One wonders if this is not a misprint, since, under all standardization actions of recent years, including that of the present report, red is recommended only where a stop is required. The use of a red signal on a safety zone would be, in my judgment, a most serious error.

Who Has Right of Way.—While the subject has never been brought up for serious discussion, I wish to question one of our most fundamental traffic rules, namely, the requirement that "The man on the right has the right of way." This matter first came to my attention in an article written by E. B. Lefferts, now of the Automobile Club of Southern California, and justifies serious consideration. The history of this regulation seems to be that in Europe, where traffic drives to the left and not to the right, the regulation was and still remains that the man on the right has the right of way. We changed this rule from driving to the left to driving to the right, but we did not change the regulation that the man on the right has the right of way. Actually, when traffic drives to the right, the man on the left should have the right of way, and most drivers agree that, in their own experience, they give right of way to the driver on the left naturally, and that to give right of way to the driver on the right is unnatural. Under the regulation of "The man on the right has the right of way," a driver approaching an intersection must keep his eye on the man who is approaching from his left, because he is the man most apt to hit him. At the same time, he must look away over to his right, to see if he must give right of way to someone approaching from that direction. A driver must, therefore, look in two exactly opposite directions at one time, and it cannot be done. If, in the exact meaning of the regulation, a driver gives right of way to a driver on his right, he stops in the intersection to do it, a position which is not only dangerous but which blocks other traffic. We may never change this rule, but after thinking about it and observing its operation for some years, I have come to the conclusion that it ought to be changed and urge the Committee to consider the matter.

My endeavor in these comments has been to present constructive criticism of the report. They are presented with the utmost respect for the difficult work the committee has had to do and for the most excellent job they have made of it. No one who has not sat on such a committee knows the difficulties of formulating exact standards from a mass of complicated opinions, practice and ideas, nor the difficulty of reconciling the opinions of the members of the committee.

The American Engineering Council's Report is as a whole most excellently done. It is a foundation on which our future traffic standards are now stated or upon which they will be built. Contrary opinions which have been expressed relate to points which, in my judgment, must ultimately be modified, if the standard is to be fully accepted and adopted by the traffic officials, who, after all, take the responsibility for the expenditure of public funds and whose reputations depend on the results obtained. The judges in this case are the drivers, few of whom can say what is right, but who are quick to know and to say so when a traffic treatment is wrong.

In conclusion, it is important to point out that these or any other standards are subject to modification in order that they may fit new conditions or as new experience may require. In their use, there will be many questions as to the meaning and interpretation of the provisions of the standard. For these reasons, the committee's work has only just begun. It is of the utmost importance that the American Engineering Council or the Hoover Conference arrange to have a committee of, say, three men who are actively engaged in traffic work and who can be referred to, to interpret the provisions, settle questions which are certain to arise, and who will keep abreast with developments so that provisions of the standard may be promptly modified when necessary. If this is not done, this will be just one more set of standards, accepted by some and misused or ignored by others.

Acknowledgment.—The above paper was presented by Mr. Kelsey before Public Safety Section of the National Safety Council at the 17th Annual Safety Congress held Oct. 1-5 in New York City.

Bridges Over Navigable Waterways

Some interesting facts regarding bridges over the navigable waters of the United States have been compiled by the National Rivers and Harbors Congress from the detailed reports made by the chief of engineers.

The total number of bridges of all kinds, in 1927, was 6,643. Of these 2,337 were steam or electric railway bridges, practically all the others being for highways, although there are a number which carry both railways and highways.

There are 3,994 fixed and 28 suspension bridges, 1,771 with swing spans, 61 with vertical lifts, 34 with pontoons, 19 with retractile and 12 with removable spans, 20 with other varieties of openings, and 37, the structure of which is not designated.

The most unusual bridge in the country is the aerial ferry across the ship canal at Duluth, Minn. A platform at street level is suspended from the bridge proper, which is 135 ft. above the water, and this platform carrying automobiles and pedestrians is moved back and forth across the canal by electric motors. This unique structure is soon to be replaced by a vertical lift bridge.

There are 39 bridges which have 200 spans or more. One at Corpus Christi, Tex., has 1,150 and one at San Mateo, Calif., has 1,278, but the prize goes to the Norfolk & Southern Ry. bridge over Albemarle Sound, at Edenton, N. C., which has no less than 2,093 spans.

There are 62 bridges which are 100 ft. or more above the water, the highest, 230 ft., being the lower steel arch at Niagara Falls. There are two other high bridges at Niagara Falls, one 214 and the other 192 ft. The third in height is the one across the Snake River at Riparia, Wash., which is 210 ft. The bridges across the East River, New York City, have a clearance of 135 ft.

The longest single span in the country is the suspension bridge between Philadelphia and Camden, which is 1,686 ft. The Detroit River bridge, which will be finished in 1929, will have a clear span of 1,850 ft., while the bridge across the Hudson at New York City, which is to be done in 1931 or 1932, will be nearly twice as long, or 3,500 ft. It is said that plans are being drawn for a bridge across the Narrows of New York Bay with a span of 4,500 ft.

Highway Traffic Association to Meet at New Orleans

The South Central Division of the National Highway Traffic Association will hold its annual meeting Dec. 3 at Roosevelt Hotel, New Orleans, La. The meeting will be held on the registration day of the 7th Annual Asphalt Paving Conference, which will be held at the same hotel. All persons interested in the advancement of the efficiency of highway transport and traffic control are cordially invited to attend the meeting and take part in the discussion of the addresses to be presented. The program of the meeting follows:

Presiding officer: Col. R. Keith Compton, honorary vice-president National Highway Traffic Association, president American Road Builders' Association, and director of public works, Richmond, Va.

"The Traffic Control Program of New Orleans," by Bryson Vallas, city engineer, New Orleans.

"The High Cost of Highway Transport of Bottlenecks," by George E. Hamlin, chief engineer of maintenance, Connecticut State Highway Commission.

"Highway Traffic Control of Montreal," by J. E. Blanchard, chief engineer of the Road Department of Montreal.

"The Traffic Control Problem from the Viewpoint of the Man of the Street," by Harold B. Pullar, secretary, James B. Berry's Sons Company, Chicago.

"One Hundred Cents for the American Highway Dollar," by Arthur H. Blanchard, consulting engineer, National Highways Association, and Highway Transport and Traffic Control Consultant.

Newark's Municipal Airport.—The first unit of the $6,000,000 municipal airport of Newark, N. J., was completed on Aug. 1.

City Held Responsible for Typhoid Cases

A decision of much interest was handed down Aug. 30, 1928, by the California Supreme Court. The decision was in the case of Rutterbusch et al. v. City of Pittsburg, Calif., and 18 other cases (269 P. 930), and is cited as follows in the Oct. 19 issue of Public Health Reports:

"Actions were brought against the city of Pittsburg to recover damages for the death of a person from typhoid fever and for the illnesses of other persons who were affected with typhoid fever and dysentery. It was alleged that the diseases were caused by the negligence of the city in permitting its water supply, furnished to the inhabitants of the city, to become polluted. The water supplied by the city required purification before being safe for human consumption, and to meet this need the city operated a chlorination plant. Evidence showed, however, that upon a certain night in the early part of June, 1920, the chlorination plant was inoperative for about 12 hours, and that during said period unchlorinated water was let into the mains. There was also evidence which strongly tended to show that an epidemic of typhoid fever and dysentery broke forth in the city within about three weeks following the admission of the unchlorinated water into the mains. Other evidence was also introduced tending to show that the period during which the diseases occurred corresponded to the time within which epidemics of typhoid and dysentery follow upon the use of germ infected water. Judgments were entered by the trial court in favor of the plaintiffs, and such judgments, on appeal by the city, were affirmed by the supreme court, which, in the course of its opinion, said:

"On behalf of the defendant it was sought to be shown that some effort was made by its agents and officials during the brief period when its chlorination process was not in use to purify said water by other means, such as the introduction of lime into its content; but this evidence was unsatisfactory through the failure to show that the substituted method either would or did have the effect of purifying said water.

"Considering the evidence in each of these cases as a whole, the deduction seems to be inescapable that the epidemic of typhoid fever and dysentery which broke forth in the city of Pittsburg within the aforesaid period after its agents and officials in charge of its water system had permitted unchlorinated water to be served through its water mains to its inhabitants was directly traceable to that cause, and that the cases of death or illness which form the basis of these actions were the direct result of the negligence of the agents and officials of said municipality in the foregoing regard.

"The argument put forward by the appellant to the effect that the epidemic in question might have had its origin in other sources, such as the use of water from wells in various parts of the city, creates at best but a conflict in the evidence as to the source of infection, and this evidence is weakened as to its inferences by the fact that, while these other sources of water supply had existed for a considerable period of time prior to the month of June, 1920, no epidemic had resulted until the particular period following the pollution of the municipal water supply.

* * *

"Treated by and large, we are of the opinion that the judgment rendered and entered by the trial court in each of the foregoing cases is sufficiently supported by the findings of fact and conclusions of law applicable to each of said cases, and that as to each, the evidence was amply sufficient to justify the findings of fact and conclusions of law of the trial court."

Adaptability of Asphalt Pavements

Universal Use of Mixtures for Resurfacing and Temporary Surfacing Discussed

By WALTER H. FLOOD
Walter H. Flood & Co., Chemical Engineers, Chicago, Ill.

ONE of the distinct advantages of the asphaltic type of pavement and one which is frequently overlooked by engineers and city officials is the ease with which it can be adapted to the restoration of old pavements and road surfaces which from various causes have been rendered unfit for present day traffic.

It is common practice to cover old brick pavements with an asphalt surface, although even here, too, often the entire pavement is rebuilt at an unnecessarily high cost to the taxpayer. However, there is more hesitancy exhibited in dealing with the problem of other types of construction such as macadam streets and gravel roads, either plain or tar treated, disintegrated concrete or asphalt pavements which have worn out either through years of service or faulty design.

Any pavement surface of whatever type, if it is to be at all lasting, must of necessity be supported on a firm foundation, although, contrary to widespread belief, this is somewhat less true of an asphalt pavement than of the rigid types. There are numerous examples of asphalt surfaces on black base where the subgrade is slightly yielding, which although they have become uneven in contour are unbroken and are giving good service. Under the same conditions a rigid pavement fractures from lack of subgrade support and rapidly breaks up and disintegrates. It is not advocated that less attention be paid to the foundation conditions of an asphalt pavement than for other types, but a point to be noted is that frequently it is necessary to construct a pavement on a new fill or other character of soil which could only be made perfectly firm at a cost which would be prohibitive or unwarranted, considering the amount of traffic to be carried. Under these conditions, unless the movement of the subgrade is excessive, an asphaltic type of construction lends itself admirably as being the most economical and serviceable.

In resurfacing an existing road or pavement with asphalt it is not only important that the foundation be firm and well drained, but it is equally essential to provide some means by which the asphalt wearing course will bond to the surface of the old pavement in order to overcome any tendency of the asphalt to displace. This is a detail which is frequently neglected not only in resurfacing but also in new work on a concrete base where a smooth surface of the concrete is insisted upon in the erroneous belief that a smooth surface on the base will produce a smooth wearing surface. Disastrous results usually follow such practice, for not only is it difficult and frequently impossible to obtain a smooth initial surface due to the shoving of the mixture under the roller, but there is grave danger of serious displacement after the street is thrown open to traffic. This displacement is one of the defects of an asphalt pavement commonly attributed to the asphalt itself, whereas, it is in many cases due entirely to a lack of provision for a means of bonding between the wearing surface and the base on which it is placed. If the surface of the base is rough, or other means are provided to secure a bond to prevent longitudinal movement of the asphalt, the tendency to displacement will be greatly minimized, and the only movement which can then take place will be due to an improper surface mixture. This fact is recognized in the use of various mechanical devices for producing a rough surface on concrete foundations. Distinction must be made between a rough surface and an uneven one. If the base prepared to receive the wearing course is uneven in contour, there is a great possibility of this unevenness appearing on the surface of the finished pavement, and in fact, this is one of the principal causes of irregular surfaces of asphalt pavements. It is therefore important that whatever method is employed in obtaining a rough surface, the general contour of the street should be maintained and any tendency to produce depressions should be avoided. Should there be deep depressions as usually occur in old pavements to be resurfaced, they should be filled with binder mixture so as to make a fairly even contour, or in the case of gravel and macadam roads they may be shaped up and the depressions filled with stone or gravel thoroughly rolled in place. Care must be taken in the preparation of old macadam pavements that there is not an excessive amount of fine material present, thus making the surface too tight and smooth and preventing a proper bond for the asphalt. The surface of such roads should be broomed, water being used if necessary, to remove all dirt and fine material and leave the surface in a uniformly rough condition. Very often a scarifier is used to an excessive degree in shaping up a road for surfacing, with the result that the solidity of the base is greatly impaired, increasing the tendency to settlement and other movement. The existing roadbed should be disturbed as little as possible in order that it may be firm and unyielding before placing the asphalt mixture. Where the subgrade holds water, proper drainage should be provided.

The resurfacing of concrete pavements requires a somewhat different treatment, as they have little or no crown, and usually the greater area of the surface is too smooth to afford a bond with the asphalt. The concrete may be roughened with picks or pneumatic chisels, but a more satisfactory method for holding the wearing surface is to apply a paint coat of asphalt cement, cut back with naphtha, over the entire surface of the concrete. The pavement should be thoroughly broomed and washed with water so that all dirt and fine particles are removed before the application of the cut-back in order

Resurfacing Old Concrete Pavement with Two-Inch Asphaltic Concrete

Applying Asphaltic Concrete as Resurfacing to Rough Concrete Pavement. Note Cut-Back Paint Coat Applied to Old Concrete, Quincy, Ill.

to insure its thorough adhesion to the concrete. The paint coat should be applied as thin as possible, as an excess will tend to soften the asphalt surface mixture. Rubber squeegees can be used to apply the paint, but if the surface of the concrete shows many irregularities and depressions, as is usually the case, better results can be obtained with brooms. Before the cut-back is applied, all loose concrete should be removed and the holes filled with black base or concrete. Sufficient black base or binder mixture should be used to give the street a good crown and it may be necessary to lay the asphalt with a depth three or four inches greater in the center than along the curb line. When there is gutter slab on the street to be resurfaced, this can be covered the same as the rest of the pavement and the asphalt surface mixture brought to the curb. It is not necessary to lay the asphalt to the full thickness along the gutter, and in this way considerable material can be saved, with consequent reduction in cost. For sheet asphalt the wearing surface can be bid on a square yard basis with all binder by the ton, and for a one course pavement the entire mixture can be bid on a tonnage basis, leaving to the discretion of the inspector the amount of material necessary to secure the most satisfactory results. This method will be found most economical, as it avoids the necessity of using the minimum specified thickness over the high areas of the existing pavement, which are usually very small compared to the entire surface.

Binder Course Being Laid Over Old Brick at Danville, Ill.

In resurfacing old worn out asphalt pavements, a similar procedure is followed. If the pavement surface still contains considerable asphalt, it is not necessary to apply a paint coat, as the fresh hot surface mixture will bond to the old provided that the latter has been thoroughly cleaned. However, as most asphalt pavements which require resurfacing are more or less deficient in bitumen, it is better practice either to apply a paint coat or to soften the existing surface with a heater. When the surface of the asphalt is fairly continuous, as is the usual condition, a one-inch resurfacing will ordinarily be found sufficient, using binder to fill the depressions and to replace disintegrated areas.

There can be no question that with good workmanship, a properly designed mixture and careful attention paid to secure a firm, well drained foundation, suitably prepared to hold the wearing surface, a satisfactory and lasting pavement will be assured. It is the neglect of one or more of these factors which causes failure. No other type of pavement adapts itself so readily and universally to the various conditions met with in practice as does asphalt.

Old Penetration Asphalt Street Before Resurfacing with Two-Inch Asphaltic Concrete, Bluefield, W. Va.

Two-Inch Asphaltic Concrete Resurfacing Over Old Penetration Asphalt Macadam Pavement. Pavement Along Rails Surface Treated Only. Photograph Taken Four Years After Construction

Meterage Financial Advantage to Consumers

In their fourth annual report for the year ending June 30, 1928, the Trustees of the Bath Water District, Bath, Me., set forth as follows the advantage of meterage:

"As your trustees have repeatedly pointed out, by far the greatest expense of operation, amounting to substantially 75 per cent of total expenditures, is in the pumpage of water, including labor, fuel and power. Universal experience has demonstrated that the best, and indeed the only practical way to reduce that item of expense, is to require all services to be metered. Under existing local conditions, we have hesitated to require, at present, a general metering by all consumers. The increase in metered services during the last two years has not been encouraging, the number added being only thirty, making the present total of all metered services 789. We cannot too strongly impress upon consumers, particularly domestic users of water, that the installation of meters is for their own financial advantage. The initial cost of installing a domestic meter, which remains the property of the consumer, is small, and the saving in water rates is considerable."

Planning Principles for Smaller Cities

Suggestions for Carrying Out City Planning Programs

By JACOB L. CRANE
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FIRST of all a good city plan should reflect the sound ideals and ambitions of the city for which it is prepared, and not only the preconceived theories of city planning as pronounced by the planning expert. It strikes me that a good deal of city planning publicity work and what is termed public education is unconsciously aimed at cudgeling the public into an acceptance of the city planner's theories of what the city should become and of the means to attain that end. The converse of this point of view is in reality more nearly sound.

The Publicity Campaign.—The "publicity" campaign should be aimed to arouse the citizenship to a free consideration of the city's destinies and problems and the city planner should properly be sensitive and responsive to the townspeoples' own ambitions and ideals and not solely to his own.

There are, of course, two arguments against this suggested point of view; first, the danger that what I have called the townspeoples' ambitions will resolve themselves into the purely material ambitions of individual property owners and business interests, and second, that the characteristic joint ambition of the American town does not permit of the application of the ideal type of city planning theory. In answer to the first of these arguments I would say that if the citizens are given a good opportunity during the preliminary discussions to formulate their ideas of the town's development there will be no lack of consideration for the city's welfare as a whole, and that the unsocial objectives of individuals can be readily sorted out. To the second argument I would ask, who can say precisely what the soundest city planning theory for a town may be, unless it is the ideals of the community itself?

An Important Basic New Idea.—An illustration of an important basic new idea just now emerging from obscurity in the public consciousness is the tendency to face residences away from the street, placing the service entrance toward the road, reducing the size of the front yard, and facing the living quarters to the "rear" where private play space and gardens may be developed. This idea may vitally affect the future city planning of our towns, and in my opinion the tendency is a good one. The point here is that too arbitrary zoning, building and platting regulations, although conceived in good faith, might serve as an obstacle to this logical and desirable tendency.

The American city is unlike any of the city types for which the earlier city planning theories were developed, and furthermore, its destiny as a physical organism is still obscure except insofar as we can appraise the significance of the underlying factors and tendencies and popular ideals which emerge year by year. It is my feeling that while more time and trouble and sensitiveness on the part of the city planner are required to put this principle into effect, it nevertheless remains a principle that the American city will achieve its destined sound and characteristic development only if the city planner and the city plan reflect as fully as possible both the expressed and half-unconscious ambitions of the people themselves. Obviously this principle applies with greater applicability to the smaller city where it is more nearly possible to get at the public sentiment than in the heterogeneous larger cities already prematurely crystallized in their physical form.

What the City Plan Should Interpret.—The city plan, then, should interpret and formulate and devise means for putting into effect what we may call the popular image of what the city should become. The city planner must, of course, suggest directions which the popular idealism may take, but his real job is to establish practicable plans and procedures toward the realization of a sound popular ideal. In doing so, however, the second principle appears, namely, that the greatest advantage of city planning for the growing American town lies in what we may call the guidance factors, and not in the proposals for costly re-construction. By guidance factors I mean building codes, zoning ordinances, subdivision control, supplemental building lines, guidance in the acquisition of public lands at an advantageous time, and control to prevent undesirable conditions from growing worse particularly in such matters as the location and arrangement of buildings along streets which require re-construction for widening.

For two reasons this principle applies with special emphasis to the smaller city. Such cities are not financially capable of carrying out elaborate and re-construction plans. And since their major development is still ahead of them, the proportionate value of the guidance features is even greater than in the big cities. For the sake of the planning program itself there should be special emphasis upon those features of the plan which control new building and new development because through them critically important objectives can be attained at little or no cost to the community which in itself tends to stimulate public interest and support for the entire project. These guidance or control elements of the plan are frequently found to be more urgent than the elements calling for expensive clearing of land or reconstruction, because by virtue of them the otherwise inevitable danger of creating conditions which will later require rebuilding is largely avoided.

Effect of City Maturity on Planning.—From the planning point of view cities vary greatly in their degree of maturity, and this variation seems to be more or less independent of their actual age. I have found comparatively old towns quite immature in their planning outlook and quite incapable of utilizing more than the most elemental planning control. On the other hand I have found growing cities of considerable size as yet young in years, but mature in their civic outlook and capable of going far with city planning programs. Some of the factors controlling this situation are the character of the population, the nature and quality of the city government and even the type of public education. From this consideration the principle emerges that for each city the planning proposals made for adoption should be in scale with the city's capacity for applying them. This is true in determining the degree of elaborateness and complexity of the zoning ordinance, the subdivision control, the proposals for acquisition of public land, and perhaps most of all with the suggestions for projects which require the unusual expenditure of public funds on street widenings. Again this principle applies with particular force to the smaller cities where it is possible to appraise with fair accuracy the city's capacity for utilizing a city plan and where the necessity for moderation in the proposals is greater because of the smaller funds which will be available.

Premature Crystallization of City Planning Theory.—Finally, I would like to lodge a protest against what has seemed to me to be premature crystallization of city planning theory, particularly when put into effect through specific legal regulations. Every phase

of American city planning is and should be considered to be still in the process of formulation, and both the city planner and city governments should not only make it possible for plans and ordinances to be revised, but should actually encourage the instigation of new principles so long as these principles have to do with the sound logical development of the city as a whole. The imposition of planning regulations requiring road dedications of a certain width on all section lines and half section lines without a definite plan to guide the location of the roads, the acceptance of the theory that a certain type of building will always be characteristic and necessary, for example, tenement-like apartment houses, and reliance upon any one type of transit as permanent and exclusive of all others, are typical of the kind of thing which I have in mind. It has occurred to me that the rigid exclusion of all industry from residential districts may eventually militate against both a desirable type of industrial development and against the soundest physical growth of the city.

There are many examples of craftsmen type of industry which would suffer materially if required to locate in the dirtier industrial districts and which might appropriately be placed in residential districts with plenty of growth around them, with considerable advantage both to themselves and to the workmen and their families who have to go to and from these factories. In general, the problem of transportation for factory workers tends to increase as industrial districts are limited and residential districts grow farther and farther from the places of employment. These are only incidental illustrations of the principle that the whole city planning movement should be free to accept modifications in accepted theories as time goes on and new tendencies arise. For the smaller cities where there is still the opportunity to take advantage of new knowledge and new devices this principle is particularly valuable.

The four principles above stated are, I realize, subject to discussion. It is by such discussion, instead of by plodding along accepted channels, that the science and art of city planning will develop and more nearly fulfill its greatest usefulness.

Concrete Suggestions for City Planning Program.—To reduce this abstract discussion to concrete suggestions for carrying out a city planning program in a smaller city the following outline is given, with the qualification that it should be varied to meet individual local conditions:

First—Authorize by ordinance and organization a city planning and zoning commission—not a zoning commission only, nor separate commissions for zoning and city planning. The commission should be small in number, ordinarily not to exceed nine, and should have a personnel of the highest qualifications representing various interests. It is desirable that the mayor, at least one member of the city council, the city engineer, the city attorney, and a member of the park board be included.

Second—The commission should hold preliminary meetings to formulate the principal city planning problems; to determine the amount of necessary funds which should be appropriated for their work; and to draft an outline of advisory committees which may work with the central commission.

Third—Ask the city council for a definite appropriation for the first year's work with a statement of anticipated needs for succeeding years.

Fourth—Engage a planning consultant. Do not hire the "cheapest" man.

Fifth—Initiate a program for presenting to the public the development problems of the city and for securing as specific reactions as possible to these problems and to the general question of "What kind of a city shall we develop here?" Questionnaires and meetings with individuals and committees have been used to good effect.

Sixth—Get consultant's immediate advice on temporary control measures such as interim zoning ordinance and preliminary platting control, and submit recommendations to the city council on these measures.

Seventh—As each section of the plan develops and becomes ready for adoption secure as full public discussion as possible before presenting work to city for passage. Neighborhood meetings and meetings with civic clubs and individuals have been found valuable.

Eighth—Do not be satisfied with the mere presentation of report and plans, whether or not published. So far as possible present to the city council concrete recommendations, ordinances and plans which may be officially adopted, and follow them through to adoption.

Ninth.—Publish and distribute widely the reports and plans of the entire project.

Tenth.—Do not consider the plan commissioner's work finished when the plans are done, ordinances adopted, and report published. The commission should be a permanent institution with several specific duties such as examination of subdivision plans, and even more important duties in initiating modifications of the plans and ordinances and entirely new projects.

The above outline does not include a great many details which will follow as a matter of course if a consistent, consecutive program is carried out, such as the creation of boards of zoning appeals, and conferences with other public authorities such as school boards and park boards. In my experience city planning has been greatly delayed in many towns because no one seemed to have a definite idea of precisely what steps to take in getting the work started. After a definite program, such as the one outlined, is adopted, the earlier inertia rapidly disappears and the project goes forward by its own momentum.

Acknowledgment.—The foregoing is taken from a paper presented at the 20th National Conference of City Planning, Dallas, Tex.

Conference Approves Commercial Standard for Unions

Approval of a proposed commercial standard for malleable iron or steel screwed unions for use with standard weight pipe, was given Sept. 24, 1928, by a general conference of interested elements of the industry. This conference was held under the auspices of the Commercial Standards Unit of the Bureau of Standards, Department of Commerce.

This commercial standard pertains to black and galvanized types of brass seated malleable iron or steel unions.

Following the presentation of the proposed standard by Mr. R. E. Bryant of the Jefferson Union Co., Lockport, N. Y., Mr. I. J. Fairchild of the Bureau of Standards explained the operation of the certification plan that has been developed for industry.

The conference agreed that new production, in accordance with the schedule as defined by the standard, would begin on May 1, 1929, allowing until Nov. 1, 1929, for industry to use up existing stocks. The standard will be subject to annual review by a standing committee, in order that it may be kept abreast of such changes as may take place in the art. Members of this standing committee are: Robert E. Bryant of the Jefferson Union Co., Lockport, N. Y.; Myron H. S. Affleck of the Star Manufacturing Co., Providence, R. I.; Stanley G. Cady of the Rhode Island Fittings Co., Providence, R. I., representing the manufacturers;—The Stanley Sanitary Manufacturing Co., Fleck Brothers of Philadelphia, General Fire Extinguisher Co., Hajoca Corporation of Philadelphia, representing the distributors;—the Master Plumbers' Association, the Master Steamfitters' Association, American Gas Association, the Heating and Piping Contractors' National Association, representing the consumers.

Mr. Fairchild stated to the conferees that the Department would prepare the standard for submittal to industry for signed acceptance, at an early date. He also called attention to the fact that at least 65 per cent of the industry, by volume of annual production, must accept the standard in writing and with no outstanding opposition from the others, before it will be published by the Department of Commerce.

Conservation and Control of Ground Water

Recent Experiments in the State of Florida

By CHARLES CARROLL BROWN
Associate Editor, Municipal News and Water Works

THE West Indian tropical storm of September, 1928, was perhaps the greatest in history, in extent, if not in damage to property and life. After doing great wind and water damage in Porto Rico and in the West Palm Beach and Lake Okeechobee region of Florida, the storm turned to the north-east and did much damage mainly by heavy rainfall and flood in the states along the Atlantic seaboard from Northern Florida to New England. The floods were specially destructive in the states from Georgia to Virginia.

Across Florida run several rivers draining the southern portion of Georgia, which were swollen beyond the experience of a century, such as the Suwanee, Withlacoochie of Georgia, Ocklocknee, and others. Florida State Highway No. 1 crosses these rivers and was washed out in unexpected places and covered with water to an unexpected extent. One man has been found who thinks that he remembers a somewhat similar height of waters in 1848 or 1849, but otherwise there is no record or rememberance of the like since the first Spanish occupation of the state.

One series of washouts and floodings of the highway was due to the same storm but not to any of the rivers mentioned. These disturbances of roadbed are located near Live Oak, Fla., south and east of the Suwanee River but not drained by it. This portion of the territory is cut off from the river by a sandy ridge and has no outlet over the surface for its drainage. There are numerous lakes, ponds, swamps and low areas dividing the areas into many small watersheds, the water falling on which drains to these lakes or disappears in the sandy soil and ultimately reaches sink-holes apparently connecting with water passages in the limestone with which the state is underlaid at a greater or less depth. The central portion of the state from the north boundary south has numerous areas of the same sort, broken between the Suwanee River and Polk County by but one stream, the Santa Fe River, a tributary of the Suwanee.

Water Supply Sources.—This central portion of the northern half of Florida rises to a height of 200 ft. above sea level, more or less, in fairly well defined ridges apparently formed by a backbone of stratified limestone sloping east and west from an anticline. Practically all the municipal water supplies of the state are obtained from deep wells drilled until they reach "crevices" in the limestone sufficiently open and supplied with sufficient water to furnish the needed supply. How much of the water in these lower strata of limestone has its source in the sink-holes described is as yet unknown.

Unfortunately the cities in this portion of the state are not many of them located on the rivers and they are obliged to discharge their sewage, whether purified or not, into the sink-holes in their neighborhoods. The development of the country is adding to the pollution of the surface water draining into the sink-holes at the same time that the growth of the cities is adding to the pollution by sewage.

The larger cities of the state are located along the Atlantic and the Gulf coasts and are obtaining their water supplies from the same or similar substrata of limestone at greater or less depths by means of deep wells but at points nearer the common outlets of the strata, the depths of the Atlantic Ocean and the Gulf of Mexico. Some of them are close enough to such outlets to have drawn water, by pumping excessively during long periods of rainfall below the average, more rapidly than the depleted strata could furnish it, and consequently have drawn salt water into their supplies either from the sea or from other "crevices" connecting with the same or other sources of salt water. Such cities as Tampa, West Palm Beach, St. Augustine, St. Petersburg, and others have been obliged to seek other supplies and have built or are contemplating works to furnish treated surface water. Tampa has secured a satisfactory supply in this way, but not all cities are able to find such a nearby and adequate supply as that city.

Some of the largest springs in the world flow from outcrops of the underlying rock, or from near-outcrops and a few sink-holes operate in the reverse direction when the pressure of water in the "crevices" is high enough, owing to excess supply, to force the water out. Some of these springs are looked at with longing eyes as sources of future water supplies.

Conservation and protection of the underground and surface waters of the state has therefore become a very important problem. Recognition of its importance to the material interests of the state cannot be long delayed. Possibilities of pollution of present underground sources by future settlement of the state and methods of preventing such pollution if found possible are subjects demanding prompt attention and intensive study by experts.

What the Soil Maps Show.—In general the soil maps of counties show various fairly well-defined surface areas of sand of various kinds and sizes and mixtures of sizes and with various mixtures of clay, loam, silt, and organic matter, and of various clays. Ordinarily the surface is sandy but excavations, deeply cut stream channels, etc., show undisturbed clay beds underneath, ranging from gumbo and similar material rich in clay, to sandy clays or clayey sands. In these areas the rainfall, unless too heavy or long continued, is more or less gradually absorbed by the soil and finds its way slowly through the fine sand to outlets in springs and streams or directly into the underlying limestone. Excavations show seepage of this water through the sand and the characteristics of this flow of water and the relation of its presence in the subsoil to the amount of rainfall are quite well understood though not always studied so carefully as they should be in connection with the foundations of surface or underground structures. There is room for investigation on this line.

Studies will be simpler than in the North since there is not enough freezing of subsoil within the state to introduce that complication.

One of the washouts on Highway No. 1 illustrates many of the points above noted and may serve as an introductory illustration of the problems of detail to be met and the present methods of attacking them.

Cause of the Washout.—Many of the lakes, ponds and low spots in a sink-hole region are somewhere near the same elevation, even when the country is rolling. Since the seepage of water through the sand is slow, on account of the fineness of the sand, the ponds and low spots will fill up and water will overflow from one to another according to which one fills first. When an excessive rainfall occurs, such as the 10 in. in 24 hours, more or less, of the September storm, in areas of considerable size, several of these areas will be joined in these overflows and the run of the water will be from the ponds with on ordinary outlets to those with sink-hole connections. The washout in question seems to have been at a point where usually the amount of drainage water over the surface is slight and it was taken care of satisfactorily by the usual rather shallow ditch along the road, leading to a culvert under the

road at the low spot in the grade. This ditch was some 15 or 20 ft. above a lake with a sink-hole outlet, the ditch being on the southern side of the road and the lake some 100 ft. north of the road and at the foot of a gentle slope which was not washed by any water falling on the road or north of it. The culvert was an 18-in. vitrified clay pipe with head-walls and ample and safe passage down to the lake.

The road gang reports that the water from the ditch and apparently also through the ground found its way along the outside of the culvert pipe and began to run round the head wall and wash the bank. Usually it is easy to stop such leaks but in this case it could not be done readily and the bank was cut down until there was a wash-out across the road 15 ft. or more in depth. This depth of outlet for the ditch caused the cutting of a trench parallel to the road each way from the break, taking in a part of the pavement for 50 to 100 ft. in each direction and extending 200 or 300 ft. farther in each direction. Meantime the rolling fields had collected water in the low runways and ponds and swamps, which ultimately reached the ditch and cut it out still farther, especially to the east of the break, on account of the overflow from a pond to the south-east which, when filled by the rainfall had enough water and fall to cut the ditch along the road to a depth of 10 to 15 ft. and a width of 30 ft. or more, down to hard pan, which was about 5 to 10 ft. above the ordinary levels of the lake on the north side of the grade.

This cut laid bare about 15 ft. depth of bank on the south side of the cut and showed it to be sand with some mixture of clay and loam all the way down to the hard pan and of varying density. Its appearance coroborated to some extent the statement of the foreman that the seepage of water from the south bank after the washout had the appearance of coming out so rapidly in spots as to almost seem to be coming in streams. This is an exaggeration, of couse, as the bank after several days was still standing very nearly vertical, but with slumps at the points where the soil was lightest and the seepage water had come through in largest quantity. These points were at and within a few feet of the culvert at which the break occurred.

It seems evident that the principal reason why the road gang could not stop the flow of water across under the road surface was the saturation of the entire depth down to hard pan by the seepage so that the bank was too soft to hold ordinary piling or filling material, and was ready to go with a minimum of water flowing through along the culvert pipe. The amount of water being augmented progressively by the arrival of overflows from various sources, the destruction shortly became complete.

Method of Repair.—The method of repair is to lay 75 to 100 ft. of tile in the bottom of the cut in each direction at the level of the outcrop of hard-pan in the bottom of the cut near the culvert and surround that with small stone and boulders to form a French drain along and beyond the soft spots developed in the bank; discharge these drains into the bottom of a catch basin some 15 ft. deep, from which a 48-in. cast iron pipe runs across the road and discharges at the toe of the new slope of the fill across the break, 5 to 7 ft. above the ordinary levels of the water in the lake and with a safe and easy channel to it. The cut will be filled up nearly to the former elevation of the ditch and will be seeded as before and will be ample to carry the surface water to the catch basin. The ground water will then be kept drawn down so as to exert little or no pressure on the soil under the road and there should be no danger of the same occurence again.

The evidence is so clear and is on such a scale that it is thought useful to give this description as an aid to theory furnished by observation and a guide to what might be done to prevent such occurrences before the exceptional happens. In the present instance there seems to have been no way to foretell what happened unless some seepage coming out of the bank on the lower (north) side of the bank had been observed and the reason therefor had been hunted out.

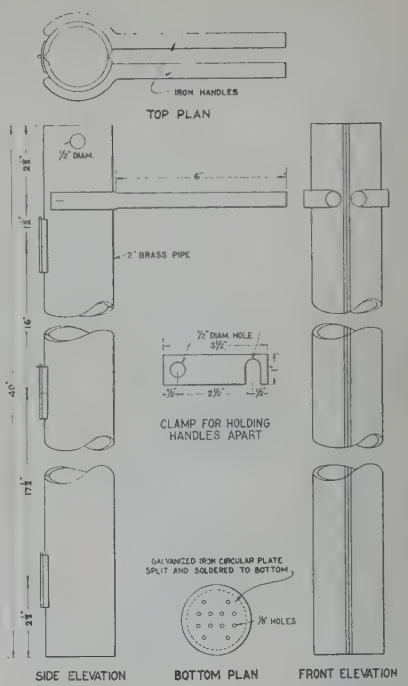
Filter Sand Sampler

There are a number of methods that may be used in collecting sand samples from rapid sand filters for sieve analyses, but the method described below has been found best at the Chain of Rocks filter plant of St. Louis, Mo., for obtaining a representative sample since it eliminates the possibility of mixture of the upper layer of sand with the lower layers.

The collector is a 2-in. split and hinged brass pipe, which is lowered vertically into the filter bed during washing and is then withdrawn after the wash-water has been shut off and the sand bed completely drained.

The clamp shown in the drawing (Fig. 1) is placed over the outer ends of the handles so that the open slit stands apart from ½ to ¾ in. The pipe is lowered into the filter by a rope passing through the ½-in. hole in the top of the pipe. The lowering should not begin until after the full rate of the wash-water in the filter has been attained and then should continue very slowly, the time of lowering to be fully 30 seconds. Afeer allowing the pipe to remain standing on the gravel bed for several minutes, the wash-water should be shut off slowly and the sand bed drained. It is very important that this be done before proceeding.

The clamp can now be released and the handles brought together, closing the split in the pipe. Care should be taken not to exert too much pressure as the sand will tend to rise in the pipe, thus elongating the sample. After withdrawing, the split pipe may be laid out opened on the table, the excess sand from each half of the pipe trimmed off and two samples of filter sand of known volume obtained.



Details of Collector for Sampling Filter Sand

Samples formerly were obtained by driving an angle-iron into the gravel, and then driving another alongside. The two irons were then withdrawn with a section of sand between them. The sand was trimmed off to the edge of the iron and the sand remaining was used as the sample.

Inspection of Fire Hydrants

Hydrant inspection at East Orange, N. J., through cooperation with the fire department. The Board of Water Commissioners have a school for the instruction of firemen as they come new into the service so they will become familiar with each type of hydrant, its operation, and the difficulties that are likely to occur. Every hydrant in this city is numbered. Twice a year the fire department inspects every hydrant. A form made up in card size, 4 by 6 in., which the men can readily carry in their pockets is used. On this card are shown in the different kinds of difficulty that may be encountered. The reports of inspections are turned in to the water commissioners each morning, and inspection and repairs, unless they are major repairs, are made the same day. On the following day the report goes back to the fire chief, and he then knows that the hydrant is in good condition.

Factors in Design of Distribution Systems

Fundamentals Governing the Proper Design

By V. BERNARD SIEMS
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WHILE distribution systems may be designed to satisfy all of the recognized factors which make for an ideal hydraulic structure, the system which it actually constructed depends largely upon the amount of funds available or upon the attitude of the financiers who supply the capital. In such a situation where the factors given consideration are little more than the construction cost of a system to deliver water for merely domestic purposes, and the design of the distribution system is often justified economically because such justification is based upon incomplete premises—i. e., without due consideration being given all of the factors which should have weight in design. In the division of opinion on this question of first costs versus ultimate benefits, those responsible for design are generally grouped according to whether or not the capital for improvement is supplied by small private interests or by large public utility operators such as the water utility parent companies and municipalities. But notwithstanding this phase of the problem and the knowledge that sometimes in the case of local private companies and small municipalities, the ultimate benefit to be realized from model design is disregarded for the more immediate charm of low first cost, the true economic design which is also the proper physical design of distribution system, depends upon technical factors which are fundamental and hence unchanged, except relatively, by the consideration of cost as a major factor. Therefore, this paper will treat only of the fundamental factors governing proper design of distribution system, although for the purpose of illustrating the economy of proper design, first costs will be discussed.

Elementary Factors That Must Be Known.—Before a study leading to the design of a system is begun certain elementary factors must be known, one of which is the practical objective of the contemplated water system, whether a limited and restricted area is to be served or whether the area has prospects of expanding; and if expansion is reasonably expected, in what manner, at what rate and in what direction such expansion will take place; whether or not the development will be industrial, residential or whether the characteristic growth will be mixed and indeterminate.

Another elementary factor to be recognized is the source of supply. Thought must be given to the available capacity and suitability of supply for the designed use, its general plan of distribution, whether gravity or pumped, the ultimate complete economic development of the chosen source of supply and probable utilization of additional available sources within the period of time considered as a basis for the estimates of future requirements.

A third elementary factor is concerned with metropolitan districting of the water supply utility. Water supply districting and creation of metropolitan utility areas is tardily receiving the attention which this necessary outcome of our population tendency deserves and is following the load of giant electric utility development work under the fostering influence of water utility parent companies controlled by private capital. Hence in designing a system, sight must not be lost of the relation which the system will bear to neighboring communities with or without public water supply and the water supply district within whose boundaries it will be located, nor of whether or not such a district is already organized and water supply sources controlled through previous allocation.

The above mentioned factors are then the general phases of the problem of designing distribution system which must be introduced and investigated thoroughly for a broader understanding of the complete problem before beginning the detail work on the design. Yet while these general factors are important in determining the nature of the source and its usefulness to meet demands of future growth, the total capacity demand to be distributed, the total capacity and the most advantageous position geographically of primary feeders, reservoirs, pumping stations and filling plants, there are other factors which more directly concern the distribution gridiron.

Fire Protection Water Requirement.—In the January issue of The Journal of the American Water Works Association, a paper by the present writer was published which covered a study of distribution design by which future fire protection water requirements was made the basic principle of design. The study embraced investigations to determine, first—the quantity of water used in combating fires of varying magnitude in various types of buildings and characters of developments or neighborhoods; second—the factors altering those quantities; third—the relationship between those quantities and the quantities representing domestic consumption in the various characteristic neighborhoods or developments; fourth—the forecast of changing neighborhoods and the effect of zoning restrictions in neighborhood changes, future growth and characteristics; fifth—the economy of basing distribution system design upon future requirements; and sixth—a method of calculating the probable future maximum water requirements. The investigations were pursued in a rather thorough-going manner in various areas of Baltimore city and environs, certain phases being conducted in cooperation with the engineers of the National Board of Fire Underwriters who were desirous of modifying the accepted but questionable practice of basing fire protection water requirements upon the single factor of population supplied.

The outcome of the study was the establishment by the writers of the fire protection water requirement based upon the estimated future growth and characteristic development of a community as the fundamental principle governing the design of distribution system. A formula was evolved which expressed in equational form this principle and which had as its factors the probable fire area involved in a serious fire in any neighborhood, the height of building, combustibility, the fire apparatus response and a correction factor known as the Baltimore Equation and developed by the writers to apply to the above a relative value for conflagration or exposure hazard. The tendency of the formula was to render more reasonable the requirements which would be placed upon a water system according to the method employed by the Underwriters. Yet the requirements as calculated by this method were sufficient to satisfy most liberal design for it made allowances for the character of the future development anticipated in determining the basic fire area.

In the beginning, the application of the principle expressed by the new formula was restricted to the design of the distribution system of the Baltimore Water Works but the method has since been given a wider application and other and more enterprising studies have been conducted into the basic principles controlling proper design. These studies have covered both large

and small, privately operated and publicly operated water works system with the result that the writers are now prepared to offer modifications to their earlier findings.

Phases Bearing on Distribution Design.—Since 1924 the idea of metropolitan water supply districting has become manifest; statistical observations of the use and life of industrial water supply sources inland and on the seacoast are available; the principle of economic development of one water source for water supply and for waste disposal has become better understood and applied, and the benefits of zoning for utility development have been recognized and use made of zoning regulations to control community expansion. All of these phases have a bearing to some degree upon the general considerations of distribution system design. Observations of residential domestic water demand peaks have enabled the writers to work out a relationship between average daily, maximum daily and peak consumption and a comparison between peak domestic demand and fire protection water demand. It has been found that this relationship throws a new light on the subject of design fundamentals and hence has an important and direct bearing upon the principle of gridiron and distribution system design. For these reasons the writers present a new or revised formula which they believe will aid in establishing a scientific rule for standardizing distribution system design within moderate capacity limits.

Capacity Demand.—In applying the 1924 method it was found that while it made the capacity demand of a large town somewhat less and more reasonable, yet usually in the case of a small town the demand still remained too great to be of practical use for controlling design. After a series of observations it was determined that this inconsistency was due to the predominating character of community development with respect to total and daily per capita water consumption. That is to say, in the large town or in any business community or area isolated for the purpose of investigation, the major portion of the total consumption is found to be consumed industrially or for commercial uses and the per capita consumption is relatively high. In these cases building areas are large and congested, and the fire hazard great. Total water consumption is uniform from day to day and is not seasonable; it does not reflect the ordinary dry or hot weather increase and being predominantly industrial the normal changes in domestic consumption rates have no appreciable effect upon it. Thus where the total water consumed is not subjected to domestic peak rates that are abnormal as compared to the daily 24-hour rate cycle, the quantity of water required for fire protection represents the maximum demand to be placed upon a gridiron and hence is the controlling factor of adequate design.

On the other hand, in residential neighborhoods and predominately residential small towns, where the water consumption is predominately domestic, the day to day rates vary considerably; dry or hot weather peaks are reached that are quite incomparable to the average maximum consumption rate. In these sections the fire hazard is slight insofar as serious fires are concerned as the fire areas are small and fairly isolated. Thus when dealing with a distribution system designed to supply predominately domestic demands it was found that insufficient capacity would be obtained if the fundamental of design was made the fire protection water requirements. Statistics gathered during a period of five years indicate, when analyzed and averaged, that for residential communities average daily consumption X 1.5—maximum daily consumption average daily consumption X 2.0—peak rate of draft. It should be borne in mind, however, that these multipliers represent averages and that the individual case may vary above or below the average. Such variations will depend largely upon the rate charged for water consumed and whether or not the service supplies are metered. Ordinary use of water as well as leakage and waste increases if the cost is too low to encourage plumbing inspection and repair or frugal consumption by the consumer.

Factors Affecting Average Daily Consumption.—If unknown, the average daily consumption can only be actually measured or guessed for it depends upon so many variable factors. But if it is known, that for any future year may be estimated by applying a capita consumption figure to estimated population, provided consideration is given to all other factors that affect total consumption. Such factors among others, perhaps local in nature are: (a) the cost of water to consumers and possible rate changes; (b) the racial characteristics of the consumers influencing their use of a purchased commodity; (c) weather and meteorological characteristics of the community; (d) the conservation measures practiced by the water utility and possible changes in policy; (e) the possible effect of the development of other domestic utilities such as a public sewerage and disposal, street washing or other increased public use of water. But having established the average daily consumption estimate, the maximum for which to design the distribution system should be the above mentioned peak rate of draft for the future year which represents the limit of economic investment in the improvement contemplated.

For the large town, except in the case of pure residential zones, or for industrial and transitional zones, the calculated future fire protection water requirement should be chosen as the design fundamental. The method followed in calculating the capacity of the distribution system should be that detailed in the 1924 paper by the present writers, bearing in mind that it is of prime importance to estimate the character of future growth accurately. No reason is seen at this time for altering the formula details of the earlier work, although some values of the graphs have been revised and the diagrams put in somewhat different form. The only change suggested in regard to the method is that its application be restricted to large towns, industrial areas and factory settlements. In the case of the town showing present mixed development characteristics one or the other of these two methods is to be applied. The reason for no compromise in the selection of the proper design fundamental is that, by virtue of the present development showing mixed character, the area can be assumed to be in a transitional state. It should, therefore, show a tendency toward either residential or industrial predomination and hence determination of the future characteristics is possible. Usually the community showing mixed characteristics is undergoing transition from low value to high value congestion of population and property.

Three Major Categories.—Thus the design of distribution system falls into three major categories, 1st, the importance and relation of the contemplated system in the general scheme of water supply development for its particular geographic area, 2nd, the character and future possibilities of the community for which the system is contemplated, 3rd, calculation of the required capacity of the system in accordance with one of the above described methods, based upon the development characteristics of the community to be supplied.

The first and second are more or less abstract, but a limit may be set for the number of years in the future to which the estimate of the character and future possibilities of the community is carried or projected. This limit will be determined by the economic amortization of the investment to be made. With a definite year limit, the estimates for the future may be fixed with a fair degree of accuracy.

Concerning the first costs of the construction of the system designed by the community served, both the domestic and the fire protection peak demands are met for other class of development, the greater demand being chosen in either case. The domestic peak demand, which as has been shown in the controlling factory for the predominately residential community, is a more tangible requirement upon which to base design than the probable fire protection water demand, because the former is the primary requisite for any water works, i. e., the supplying of sufficient water for domestic purposes.

Hence the cost of the system designed to supply the domestic demand need not be defended since it is an unalterable necessity.

The Case of the Industrial Community.—In the case of the industrial community, however, where fire protection and water requirement is the controlling factor, it is perhaps necessary to justify the first cost of the system designed to meet that requirement. The per cent cost of a public water system for fire protection is not great. It may be found by reference to the formula $Y = \frac{147}{XO.31} - 12.1$, in which Y equals per cent of total cost and X equals population in thousands. But this cost is inversely proportional to population and hence relatively greater for the small town than for the larger. Nevertheless, the relative cost for the small town is not prohibitive but in reality small as compared to the benefits of lower insurance premiums, provision against the loss of life by fire, the economic waste resulting from loss in business and unemployment and in property damage. The small town is usually dependent upon one industry which if crippled would destroy the economic life of the town itself. Furthermore, the system designed to serve the fire demand obviates the necessity of operating and maintaining house pumps in high buildings having large consumption drafts, but still more important, the construction of mains of size sufficient to serve for a reasonable future life saves the added cost of replacement by larger mains after only a few years of use.

In this paper pumping stations will not be discussed as they are considered as part of the general water supply system rather than of the distribution system. Let it suffice to say that in the properly designed distribution system which is well balanced, mains will be sufficiently large to support extraordinary drafts whether or not the pumping station serving the system is operating.

Storage and the consequent pressure support afforded by balancing reservoirs or standpipes is important as it is considered a part of the distribution system. Balancing reservoirs, particularly at the ends of long feeder mains and at the extreme boundaries of service zones are automatic pressure adapters maintaining uniform performance of the distribution system under varying conditions of draft. The presence of these adapters on the system makes possible the use of smaller feeders without increasing friction losses or adding other detriments to the service. These reservoirs also provide reserve storage to carry over chance periods of pump outages, etc., but for better distribution results it is recommended storage to be distributed among several smaller reservoirs rather than in single large capacity balancing reservoir. Both balancing reservoir storage and pumping station capacity should be sufficient, either one in the absence or during the outage of the other, to serve adequately the system whose primary main sizes have been fixed by the calculated maximum demands.

Although the system may be adequately designed by the methods herein described, it should be made further reliable by the provision of a sufficient number of line valves so placed to render maintenance of the pipe system practical and efficient, and to reasonably guarantee continuity of service by guarding against having long lines of main out of service by shutouts for any purpose. The proper number and distribution of valves is commensurate in importance to the provision of duplicate supply lines and looped feeder or primary distribution mains.

For protection of the water utility from liability for damage due to broken mains, because of the greater likelihood of broken mains where traffic is heavy and because of the congestion and importance of consumers, valves on distributing mains in congestion high value sections should be spaced at intervals not exceeding 500 ft. In other sections the spacing may be 800 ft., while on feeder mains the spacing may be increased to 1,200 ft. The required valves should be located at intersections and there should be at least three valves at each fourway branch on mains of approximately the same size.

Fire Protection System.—For the system that is designed on the basis of the fire protection water requirements, it is important that the capacity of the system be available as discharge from fire hydrants. Hence an adequate number of hydrants should be provided and so located as to concentrate discharge quantities where needed. No better spacing could be recommended than that in the code of the National Board of Fire Underwriters; which having determined the quantity of water necessary for fire protection of a characteristic area, assume a discharge of 500 gallons a minute from each hydrant and so determine the number necessary. It is true that the modern fire pumper discharges 750 to 1,000 gallons per minute, but to make the use of the hydrants more flexible it is recommended that the single hydrant be taken at 500 gallons discharge. Symmetry and system should be observed in the actual location of the hydrants. They should be placed at intersections in order to receive the advantage of the support of the tie-in mains and also to facilitate quick location by fire fighting forces. For the latter reason also they should be arranged symmetrically along a line of mains and should be placed on alternate sides of the highway to divide the possible necessity of carrying hose leads across traffic. All fire hydrant branches should be provided with valves for shutoffs in case of damage to the hydrant.

Wherever it is impracticable to support long feeder or important transmission mains with lateral mains and gridirons, duplicate feeders should be provided. These looped feeders improve the capacity and efficiency of the system and likewise are a guaranty against interruption of supply and an aid to maintenance; they are the keystone of the water distribution system.

Finally, excellent design fails if the distribution system when constructed properly and in service is adequately maintained, because of the prime importance of this phase of water works and the dependence upon it for the justification of distribution design, it is here brought to the attention of the reader. Efficient and constant maintenance must be provided if the entire benefit of an adequate distribution system is to be realized and the return on an investment in a properly designed and constructed system is to be enjoyed. A great aid to efficient maintenance is a systemized method of recording construction plans and distribution system changes, revisions and improvements. Record plates should be maintained accurately up to date showing all important parts and appurtenances of the system, and measurements.

The design of distribution system should not be discussed unless zoning is mentioned. In a community where a well regulated zoning law is practiced the work of the designer of distribution system is greatly simplified because he can more accurately foretell the type of future development of areas of population. Zoning therefore is a factor in that it reduces the degree of error in estimates of future possibilities, and hence is a guarantee against costly replacements and enlargements in later years.

In proceeding with the mechanics of design determine whether or not the community to be served will be predominately residential at the termination of the period of time considered economic for the proposed investment. If the characteristics will be residential, calculate the average daily consumption allowing 50 to 85 gallons daily per capita depending upon whether the area is purely residential or residential with small minor mercantile centers, and basing population upon estimated rate of future growth. Multiply the average daily consumption so calculated by 2 to obtain the required capacity of the gridiron. Design feeder mains of a size sufficient to deliver the required quantity to the gridiron at a velocity not greater than the critical velocity. Design secondary grid of 6 and 8 in. mains where tie-ins are greater than 1,000 ft. apart, and of 6 in. mains where secondary grid is closely tied in.

Type of Development.—If the char-

acteristics will be commercial or industrial or mixed, the process to be followed is somewhat more complicated. In developments of these classes it becomes necessary to determine to what degree the development is commercial or industrial. As a business community is a relatively unstable one, inasmuch as it changes to a more congested class reaching its limits of density in the high value commercial district, a schedule to enable to the grading of such communities is here given and the various classes defined.

1st commercial: transitional from residential representing a division of 60 per cent to 40 per cent residential.

Typical store front dwellings and minor congested areas of business houses.

Average commercial: distinctly showing business preponderance, few dwellings, some apartments and flats over business houses. Congested smaller commercial and minor mercantile areas predominate.

2nd commercial: congested pure commercial; large buildings.

High value commercial: nucleus of the business section; highly congested; most dense property value; greatest fire hazard and exposure to conflagration.

Industrial: industrial plants grouped more or less closely; individual hazards may be high by exposure not so great because of areas of vacant land or of water.

It is not good policy to assume an arbitrary demand for the purpose of determining the gridiron capacity for which to design; it is more accurate to calculate each individual problem.

Acknowledgment.—The above is an abstract of a paper presented Sept. 20 at the 47th Annual Convention of the New England Water Works Association.

Retirement Systems for Municipal Employees.—The October Monthly Labor Review of the U. S. Department of Labor contains an interesting article on this subject. As part of the general study of retirement systems for employees in various branches of state and municipal service a study was made of the systems in effect for police and firemen. Retirement systems for these employees exist in most cities and in addition to retirement allowances for members they usually include provision for the dependents of the members. The investigation covered cities having a population of 400,000 and over, and only one city was found in which there was no plan for permitting the police to retire on allowance. Of special interest are the dismissal allowances which are provided by two of the cities after a certain length of service.

Disposal of Small Volumes of Sewage

Simple Applications of Fundamental Principles of Sewage Treatment

By C. G. GILLESPIE

Chief Bureau of Sanitary Engineering, California State Department of Public Works, Sacramento, Calif.

Two practical methods for the disposal of small volumes of sewage have come to the attention of the writer. In both cases rather crude but ingenious schemes were adopted at very small cost.

How the Carmel District Handled Its Problem.—The Carmel Sanitary District of California was faced with the problem of disposing of its septic tank effluent several years ago. This tank was built in the coarse sand dunes of one of its beaches, on a blue gem of a bay. The effluent ditch, which formerly discharged directly into the bay, was filled with sludge and overgrown with weeds so that the septic effluent dribbled to the sea over the beach, creating odors and a nuisance throughout its entire course.

A proposal for dispersal through a tunnel to the deeper water was very costly, running over a million dollars. An activated sludge plant for inland disposal was also excessively expensive. The population of the district was approximately 4,000 with a flow of sewage varying from 50,000 gal. per day in winter to 80,000 g.p.d. in summer.

The president of the district, Dr. William Tower, modified an idea of the writer's in such a way that the problem was solved successfully and at a very low expense. The original idea was to parallel the shore with a long, narrow, open cesspool in the sand dunes. Check weirs were suggested for retardation of flow, but Dr. Tower laid out the pool in such a way that it formed a series of terraces, 15 ft. wide and 20 ft. long, sloping 4 in., in their length of 20 ft., to 2 by 4 in. nosings. There were two units of these terraces made up of five steps of 15 by 20 ft. each, or a total of 3,000 sq. ft.

When the beds were put into use it developed that the slope of the surface was just sufficient to cause some movement of the sand grains. The sand was very coarse, resembling a fine graded concrete sand, with approximately 0.3 mm. effective size and 2.5 to 3.0 uniformity coefficient. The rolling movement of the grains cut away or loosened most of the slimy covering which would usually seal a sand bed in a short time if dosed at this high rate. The sloping surface aided the flow of sewage and scouring action of the sand.

One set of terraces takes the sewage flow for a week easily, there is no ponding, and the sewage sinks away in a few seconds after it is shut off. The sand can be immediately raked over or resurfaced. The water plane is 10 or 12 ft. below the surface.

Another novel feature of this plant is a separate sludge digestion tank for partially digested sludge from the septic tank.

Unique Local Conditions Taken Advantage Of.—Another case where advantage was taken of unique local conditions occurred at the town of Vacaville, Calif. Effluent from its septic tank was creating a nuisance in a nearby gulley. Investment in a trickling filter would have been quite expensive. The town engineer suggested that it might be possible to pass the settled sewage over the local sewage farm in such a manner that it could be stored in ponds without nuisance during the dry months.

Following his suggestion the septic tank effluent was run into a header ditch, into the banks of which were inserted a number of pipe ports at intervals of 15 or 20 ft. The clarified sewage was released through these ports in a thin sheet which flowed through a thick growth of grass down a slope of about 1 ft. per 100 ft. The soil was quite unfavorable, being the tightest of gumbo or adobe, so that it is doubtful if much of the sewage soaked into the ground, but most of it was undoubtedly lost by evaporation and use by luxuriant growth of grass.

The sewage flow is about 125,000 gal. per day, the area of the farm 8 acres. The ponds hold 3.5 million gallons. In the eight months dry period, when the sewage must be held back, some 30 millions gallons of sewage was discharged but not more than 3 million gallons ever accumulated in the ponds.

The effluent after passing over the sloping farm and before entering the ponds appeared to be equal to a trickling filter effluent. It did not putrefy nor become a nuisance in the impounding ponds.

This simple solution of Vacaville's problem utilized some of the fundamental principles of sewage treatment, namely, removal of colloids by the straining action of the heavy growth of grass, aeration and re-aeration by absorption of oxygen in thin sheets, and finally photosynthesis by prolific growth of algae.

Acknowledgment.—The foregoing is taken from the Sewage Works Journal, the official publication of the Federation of Sewage Works Associations.

$700,000,000 of Bond Issues.—According to a survey made by the Bond Buyer bond proposals in cities, towns, counties, and states that came before the voters on Nov. 6 aggregate nearly $700,000,000.

Design of Sheet Asphalt Mixtures for Adaptation to Special Traffic Conditions

Voidage and Shear Tests Advanced for Determining Stability

By GENE ABSON
Chicago Paving Laboratory, Inc., Consulting and Inspecting Engineers

ASPHALT paving mixtures can be satisfactorily adapted to almost any condition of traffic, providing that in the adaptation, instead of following an arbitrary "hit or miss" formula, if some preknowledge of the behavior of the mixture be available. If this forecast of the future behavior of a pavement mixture were not possible, no scientific advancement would ever be made in the art, and mixtures doomed to early failure would still be employed. With this in mind, the following brief description of one particular instance will show the general purpose of such development.

The sheet asphalt pavement section of Michigan Avenue, Chicago, from Lake Street north over the Link Bridge to Chicago Avenue, has developed in the last six or seven years very prominent and deep ruts along the curb quarter where the heavy, solid-tired busses travel in the same tracks almost constantly. The reason for thus rutting, which is NOT an inherent or unpreventable fault of properly designed sheet mixtures, will at once be apparent from the following analysis of the mixture from a rutted section:

Bitumen	11.7%
Passing 200-mesh	17.0%
Passing 80-mesh	27.5%
Passing 40-mesh	35.2%
Passing 10-mesh	8.6%

Other samples from the same source have shown as high as 13 per cent bitumen. The bitumen is greatly in excess of the requirement of rational design for the type and volume of traffic this pavement receives. The fact that at summer temperatures such a poorly balanced, excessively rich mixture possesses very low stability is the reason for the displacement which has taken place.

Fig. 2—Typical Ruts and Waving on Michigan Avenue, Chicago, at Ontario Street. Waving Caused by Busses Stopping

When this mixture was designed, if it ever were designed, proper determination of stability would have precluded the possibility of ever actually laying such an inferior mixture, by the simple expedient of forecasting that the stability or resistance to shear would be too low for the anticipated traffic.

In making repairs to the rutted areas during the past several years, no relief has been found, since equally inferior mixtures were replaced and the same results necessarily followed.

When repairs were to be made again this year, the problem placed before us was that of designing a mixture which would resist this rutting. Past experience in designing similar mixtures, as well as the results of extended laboratory investigations in the development of the shear test for stability values have proven to us that high stability could be obtained by using rather high percentages of filler with a well graded aggregate and keeping the bitumen content at a minimum just necessary to fill the voids in the dry, compacted aggregate. This is more desirable than resorting to such artificial expedients as using an abnormally hard asphalt cement in a relatively unstable mixture. Consequently the first step in designing

Fig. 1—Typical Ruts on Michigan Avenue, Chicago, Just North of Bridge

this mixture was to make voidage tests on the sand to be used in combination with 25 per cent by weight of limestone dust filler in terms of final mixture, by compacting in a steel, cylindrical voidmeter to refusal, then, by mathematical calculations, having previously determined the specific gravities of the three constituents, the amount of bitumen necessary to just fill the voids is readily computed. Such mixtures were then actually prepared in the laboratory and cylindrical specimens 2 in. in diameter molded on a hydraulic press and tested for shear strength in pounds per square inch at 140° F. All this procedure is in accordance with the regular method known as the "Chicago Paving Laboratory Shear Test," and which has been described in previous papers. The pertinent data are given below:

Materials

Sand: Grading as received:	
Passing 80-mesh	26.9%
Passing 40-mesh	39.3%
Passing 10-mesh	33.8%
Filler: Grading as received:	
Passing 200-mesh	86.4%
Passing 80-mesh	13.6%
Specific gravities at 77° F.:	
Sand	2.63%
Filler	2.71%
Asphalt cement	1.04%

Voidage Determination

27.7% filler, 72.3% sand, compacted, gives 17.98% voids.

Bitumen calculated necessary to fill voids, 7.9%.

Shear Tests

Average specific gravity of compressed cylinders	2.230
Average shear in pounds per square inch	55.0
Typical analysis of cylinders:	
Bitumen	8.2%
Passing 200-mesh	25.1%
Passing 80-mesh	20.5%
Passing 40-mesh	22.8%
Passing 10-mesh	23.4%

In plant operation no difficulty whatever was encountered in preparation of the mixture. Analysis of a random sample of the actual mixture is as follows:

Bitumen	8.1%
Passing 200-mesh	25.1%
Passing 80-mesh	21.2%
Passing 40-mesh	24.2%
Passing 10-mesh	21.4%

In handling this mixture on the street, it could readily be observed that the workability was far superior to that of the previous rich and bally mixtures. In some instances, where a batch or two contained a slight excess of bitumen of only 0.3 per cent, the difference was readily apparent, but within this range no excessive gumminess resulted.

Mixtures of this kind, with high filler content, properly proportioned as to bitumen percentage, have previously proven their stability over a number of years in withstanding the severest kinds of traffic.

State Police Recommended for Ohio.—The Ohio State Chamber of Commerce has recommended that a state rural police system be established. The report recommends that a force of from 100 to 200 men be appointed by the governor to enforce traffic laws on state highways. There are at present 14 states which have a state police system.

Subdrainage at Airports

Subdrainage pipe especially adapted for airport drainage was exhibited at the recent International Aeronautical Exposition, Chicago, by the Armco Culvert Mfrs. Association, Middletown, O. This type of drain consists of corrugated iron pipe similar to that used for more than 22 years in highway, railway and municipal drainage, but with perforations in the valley of each corrugation for a portion of its circumference. The qualities of this product, which are stated to appeal especially to airport officials and to aviators, are its non-crushability, frost-resistance and its ability to collect water rapidly.

The high drainage capacity of Armco perforated pipe is said to be due to the small, closely spaced holes distributed throughout its entire length. There are no open joints, nor can the pipe separate or disalign in service. By placing the pipe with the perforations downward water is admitted freely, while roots and soil are effectively excluded. The Armco ingot iron of which the pipe is made assures rust-resistance and durability.

Evidence of the effectiveness of Armco perforated pipe was presented in a display showing its having been used in the drainage of a number of airports, including some, like the Buffalo airport, said to be the safest in the country. The exhibit was in the charge of A. S. Rosing, Publicity Manager, with C. M. Colvin, H. E. Senf and George E. Shafer of the Association's engineering staff in attendance.

New Ohio Sanitation Manual

The Ohio State Department of Health, Columbus, O., has recently published a revised bulletin under the title, "A Manual of Water Supply Sewerage and Sewage Treatment for Public Buildings in Ohio." This manual supplants one published in 1916, now obsolete in view of modern practices. The new manual contains statutes and regulations governing the construction of sewerage and sewage treatment plants and the submission of plans relative thereto. In addition, descriptive matter and plates are included to serve as a guide to the uninitiated in the preparation of plans for submision. Proper developments of water supplies are outlined and shown pictorially. The distribution of this bulletin is only to those having specific interest in the subject, and on request.

Armco Perforated Pipe Being Installed for Subsurface Drainage at Municipal Airport, Buffalo, N. Y.

The Traffic Preblems of Pittsburgh, Pennsylvania

How the City Has Organized to Meet Traffic Situation

By PROF. LEWIS W. McINTYRE
Street Traffic Specialist, Consulting Highway and Highway Transport Engineer

AN adequate study of traffic today is not merely one of parking, signs and police regulations, but must cover about five main elements. These are:

1. Improving the city plan.
2. Zoning and decentralization.
3. Mass transportation service.
4. Railroad terminal practice.
5. Traffic organization and control—vehicle and pedestrian.

Improving the City Plan.—The problem of city planning today is not to lay out new cities, but to adapt existing cities to the needs of traffic so unexpectedly thrown upon them. A good city plan should provide: (1) the easiest means of reaching each center, (2) the easiest means of passing through each center, and (3) the easiest means of avoiding each center. Obviously such rebuilding of cities is a slow and expensive process, but citizens should insist that all improvements conform to a definite and well thought out plan and not be constructed haphazardly.

Zoning.—Zoning is also of little or no effect as an immediate aid in relieving congestion, but will be in the future. Its effect is a matter of decades, if not of generations. Its largest contribution in relieving traffic congestions will be found in its use to forestall concentration of traffic producing enterprises in narrowly confined areas, thereby decentralizing traffic through reducing the need for transportation.

Mass Transportation Service.—In entering Downtown Pittsburgh, 75 per cent of the people use one of the mass transportation agencies. The street car makes up 12 per cent of the passenger-carrying, street-using vehicles, but carries 70 per cent of the street passengers; the private automobile constitutes 87 per cent of the passenger-carrying, street-using vehicles, but only carries 29 per cent of the street passengers. These figures indicate that concentration certainly requires mass transportation. Rapid transit must also not be overlooked. A proper perspective of the transport picture involves the coordination of all forms of transportation into a well integrated whole.

Railroad Terminal Practice.—Most persons, particularly railroad men, regard the private automobile as the principal offender in causing traffic congestion. Railroads have, however, continued to concentrate their local traffic close to the business district, with the result that the streets are unnecessarily cluttered up with cross-town freight movement. The adoption of collection and delivery service by the railroads and the consequent re-location of terminals is another way in which congestion could be reduced and other savings secured through better-organized cartage.

Mr. W. H. Lyford, vice-president of the Chicago & Eastern Illinois R. R., is authority for the following statement: "A distance of two miles between locations of two stations in a large city may make a difference of 300 per cent in the interest charges on the real estate occupied by the two stations. In Chicago the interest charged alone on real estate at Twelfth Street on which a freight station is located is more than $2.50 per ton of freight handled through the station. If the station were located at 33rd Street, such interest charged would be reduced to about 80 ct. per ton. The amount of interest saved by moving the station to 33rd Street would pay the cost of well organized cartage between the 33rd Street station and the premises of the trader. The present cartage charged should be saved." Again, coordination of transportation agencies is necessary for the best and most economical service.

Traffic Organization and Control.—Minor street improvements, improved traffic direction, and restriction of traffic are the three main possibilities for better traffic organization.

Removal of obstructions, larger curb radii at intersections, laying of smoother pavements, narrower sidewalks where roadways are congested and sidewalks are unnecessarily wide are all measures whose expense is clearly justified where they will bring appreciable relief.

Improved traffic direction involves consideration of such questions as the supplementing of police control with electric control, the proper relation of signal duration to traffic volume, the development of one-way streets, traffic circles, boulevard stop regulations, uniform signs, signals and marking, uniform and adequate traffic laws and the enforcement thereof, best means of segregating traffic, horizontally and vertically, through arcaded streets, two level streets, pedestrian tunnels and separated grade crossings, determination of the average parking time demand for different classes of traffic and facilities for each, development of cheap off-street day storage for automobiles—if necessary by municipal undertaking, provision of parking and loading space in or adjacent to new large buildings by voluntary agreement or by law, staggering of business open-

Fourth Ave., Pittsburgh—A 3-Lane Street Reduced to 1 Lane by Parking

ing and closing hours so as to spread the time peak, provision of off-street terminals for motor buses and taxi cabs, etc. It is evident that some of these questions justify much greater comment along technical and economic lines, but space will not permit of their detailed discussion at this time.

An increase in the number of vehicles always retards their speed, but studies have shown that the capacity of the roadway is increased until this speed is reduced to about 15 miles per hour. Further increase in the number of vehicles not only further reduces their speed, but also suppresses traffic by reducing the traffic capacity of the roadway concerned.

Traffic restriction also suppresses traffic, but if properly applied it selects the traffic to be restricted in such a manner that the capacity of the roadway is not reduced. It restricts that traffic which is just worth its cost to those who operate it, so that the minimum economic loss to the community is incurred. In congested districts traffic which is unable to maintain a speed which produces maximum roadway capacity is very costly, when viewed from the standpoint of the tremendous expense necessary to widen existing thoroughfares to increase their capacity, while traffic which can maintain a speed above that which produces maximum use of the roadway need be given comparatively little consideration.

To illustrate: horse-drawn vehicles in downtown Pittsburgh move at an average speed of but 3.2 miles per hour, and make up but 1⅛ per cent of the vehicular traffic during the evening peak period. It is evident that this traffic is suppressing other traffic by reducing the maximum speed of potentially speedier vehicles below that speed which produces maximum street use. Therefore, prohibition of the use of certain streets during the peak period to horse drawn traffic would bring about considerable relief, and a minimum loss to users of such vehicles. At the same time suitable by-pass thoroughfares should be designated for the use of such traffic.

Again, parking cars and unloading freight from trucks at the curb is a most expensive form of street utilization from the standpoint of the space occupied, while the pedestrian probably utilizes the street space most efficiently.

The private automobile carries but 1.87 passengers per car in downtown Pittsburgh, while the street car carries 32.0 passengers per car, or 16.9 times as many. The street car takes about three times as long to clear an intersection as a passenger automobile. Therefore, from the standpoint of intersection capacity, the street car is about six times as efficient in the congested district as the passenger automobile in furnishing transportation to the people. Facts such as these should be the basis for the application of restrictive measures.

A survey of 48 selected stores in downtown Pittsburgh shows that only 2.8 per cent of the patrons on a typical day parked their automobiles at the curb. The United States Department of Commerce in their study of "Vehicular Traffic Congestion and Retail Business" shows the shopping times in large cities to be as folows: less than half hour—52 per cent, one-half to one hour—40 per cent, over one hour—8 per cent. In the Central Business District the number of vehicles found parked over one hour on a typical day was 16.8 per cent. Even during the evening peak period, 5½ per cent of the curb space was constantly occupied by parkers. These figures indicate that business interests will be best served by providing for freer vehicular movement making it easier for the bulk of their patrons to come down town, than by providing increased curb parking facilities for only a very small proportion of their patrons. These curb parked automobiles are acting like a fence around business establishments preventing many potential patrons from driving up, disembarking and shopping. In Chicago The Trucking Exchange estimated that if parking were prohibited in the Central Business District, allowing trucks to reach loading and unloading places more readily equipment could be reduced 25 per cent. This has been done and the results exceed expectations.

Of course, restrictions should be applied under the supervision and upon the recommendation of trained traffic engineers, and not as matters of political expediency. The relative convenience of different types of carriers, the class of persons carried and the effect on the transportation system and on business as a whole must all receive consideration. It is probable, however, that the generally hostile attitude of the public toward restrictions provides a sufficient safeguard against too serious restriction. The fact that restriction of parking and of freight movement in congested areas is being accepted indicates that the pressure of increasing congestion will force submission to the necessities of the situation.

Pittsburgh's Organization for Meeting the Traffic Problem.—To consider the five elements of traffic problem mentioned, Pittsburgh has:

1. The Citizens' Committee on City Plan and the City Planning Commission. The fundamental purpose of these bodies is to produce a comprehensive "Master Plan" of both county and city; indicating the more important requirements of the county area's future development and the individual relationship of various recommended improvements to each other and to the whole.

2. A Zoning law and a Zoning Board. The carefully thought out principles laid down should be adhered to and not subjected to continual sniping in the interests of political expediency, if maximum results for the future are to be secured.

3. A City Transit Commission and a Traction Conference Board. The first of these bodies is studying the question of rapid transit, and the latter governs the relations of the street railway company and the city.

4. Improved railroad terminal practice has received some consideration from the railroad organizations, but there is room for considerable further work from the standpoint of coordination of transportation agencies and the effect on city congestion.

5. For the work of traffic organization and control, Pittsburgh has—under the Director of Public Safety—traffic officers, under the Traffic Inspector, to aid traffic movement and enforce

Diamond St., Pittsburgh—Another 3-Lane Street Reduced to a 1-Lane Street by Parking

traffic regulations, and a Traffic Planning Bureau under the Traffic Engineer. This Bureau makes studies of: traffic accidents—analysis of locations, causes, protective measures; electric traffic signals—their design, location, operation, use in "tied together" control system, etc.; traffic counts, signs, road markings, beacons and other traffic equipment—their design, location and erection. The Mayor appoints the Traffic Magistrate, who has charge of Traffic Court where all traffic cases are handled, and the Better Traffic Committee, a purely voluntary group of some of Pittsburgh's most prominent citizens who give time liberally, advising on traffic improvements and securing the support of the general public.

The Better Traffic Committee functions through four regular standing committees and various special committees formed from time to time as special problems arise. The work of the four standing committees is indicated by their names, which are: Education Committee, Engineering Committee, Law Enforcement Committee and the Traffic Flow Committee. The Committee has had a voice in an advisory capacity in many of the improvements which are making themselves evident, in so far as these affect the movement of traffic and the reduction of accidents.

The Committee sponsored the Central Business District Traffic Survey, realizing that the traffic problem was largely an engineering one, and that its solution would depend upon, to a considerable degree, conclusions derived from facts rather than guess work. In accordance with the recommendations of this Survey, the Council has appropriated $125,000 for a coordinated electric control system for the downtown district based on the design submitted by the Survey. Other recommendations of the Survey yet to be acted upon will undoubtedly produce further improvements.

Acknowledgment.—The above article is taken from the June Pennsylvania Motorist.

Lamp Post Designed to Withstand Severe Impacts

The surprisingly high cost of replacement lamp posts in large cities due to breakages by auto accidents has brought about the development of a lamp post designed to withstand unusually severe impacts. A post developed by the Westinghouse Works at South Bend, Ind., was publicly tested on Oct. 23. It is stated that several blows of 85,000 lb. were delivered before the Hollowspun post, as it is named, was broken. An automobile driven at approximately 30 miles an hour was completely wrecked against one of these posts, the only damage suffered by the post itself being an abrasion caused by impact with the front axle of the car, which had been twisted back as far as the driver's seat.

A feature claimed for this post is that besides being a decorative unit along the drive, even after a most unusual blow which may break it, the post remains standing because of the rail steel inside reinforcement, thus avoiding the added danger of a heavy post falling on passengers within the car or perhaps standersby.

Air Plane "Sign Posts"

The Daniel Guggenheim Fund for the Promotion of Aeronautics has started a nation-wide campaign for roof-markings which will identify the country's towns to the aviator. Such identification is a first requisite for an air transportation system, which will heighten the efficiency of American business by swifter means of communication.

As a basis for the work, the Fund, supported by the Postmaster General, has asked some 8,000 postmasters in towns with a population between 1,000 and 50,000 to take the initiative in seeing that their communities are identified by roof-markings. The postmaster is urged to enlist the support of civic organizations such as the American Legion, the service clubs, or the Chamber of Commerce, or individual corporations. To the organization or person responsible for the identification the Fund has asked Colonel Lindbergh to send a certificate of appreciation. The record of roof-markings will be kept by the Fund and made available to the Department of Commerce, the Post Office Department and other government agencies. The movement has the backing of the Departments of War, Navy and Commerce.

Many corporations throughout the country have already been active in marking the roofs of their own buildings for purposes of aerial navigation. This is not only a civic act helpful to the community in which the corporation is located; it is also a direct benefit to business as a whole, since it is the latter which will benefit particularly from a commercial air transportation system. The Fund asks that a corporation with an available roof in an unmarked town of between 1,000 and 50,000 population should communicate directly with the postmaster.

In a printed bulletin the Fund describes the type of roof most suitable for marking and urges the use of block letters in chrome yellow with a black background. It is suggested that it should be from 10 to 20 ft. in height and on roofs preferably of tiled shingles, tin or other metal, or slate where the visibility is not reduced by smoke. Besides the name of the town or city, the marking should include an arrow pointing due north with the letter "N" over it and a smaller letter indicating the airport if there is one.

The Year in the Cement Industry

Estimating 1928 shipments of portland cement will total 175 million barrels, G. S. Brown, retiring president of the Portland Cement Association, declared in his annual address on Nov. 21 that in spite of the reduced rate of increase over 1927, there is no reason to believe the future outlook is affected.

"The reduced rate of increase reflects very definitely such factors as the slump in building awards during the latter half of 1927, which left a correspondingly smaller construction hangover for 1928," Brown said. "It does not mean that less new business has been developed during the present year or that the future outlook is affected. On the contrary, it is probable there will be a larger carry-over for next year than was available for shipment in 1928.

"In a number of districts new producing capacity has come in and in all districts we are able to make considerably more of our product than we have been able to sell. Nevertheless, I am of the opinion that those companies whose properties are modern and commercially well located, are well supplied with raw materials and are well financed and managed, have in all districts but one shown satisfactory returns.

"This statement must be modified for those mills which ship largely into seacoast territory where low priced foreign cement has forced even the best equipped mills to sell for cost or less," he continued.

Mr. Brown spoke before the 26th annual meeting of the Portland Cement Association, in session at The Blackstone Hotel and attended by representatives of manufacturers who produce over 90 per cent of the cement shipped in the United States. The main theme of his address was a review of results of association activity since the war.

"Public confidence in an industry such as ours is largely a question of public understanding," Brown asserted. "The primary objective of our work has been service to the user. Appreciation on the part of users is unquestionably the greatest factor in the accumulation of public good will.

"Perhaps we are inclined to think too little of the service feature of our Association. With the growing use and number of uses of portland cement, users have been seeking information as never before. The Association as an information bureau, acting for all the portland cement manufacturers, has handled thousands of inquiries which have enabled inquirers to use cement in a satisfactory manner."

In this review he cited 290 million barrels of cement used in road and street paving in the last ten years and 6½ million barrels used in concrete sewer pipe in the last five years.

City Planning Enabling Act Published by Commerce Department

In announcing publication in printed form of "A Standard City Planning Enabling Act," the Department of Commerce reports that with more than 530 cities and towns which it has found to have planning commissions, including more than 200 out of the 300 largest cities, there has been a growing need for carefully devised legislation to enable city and regional planning to be carried out with the best results. It is pointed out that the extent to which planning commissions succeed in promoting early and efficient physical development of land affects in no small degree the return in terms of practical usefulness, now and for years to come, of several hundred million dollars of taxpayers' money spent each year for public improvements, as well as the value and serviceability of new private construction costing several billion dollars each year.

The advisory committee on city planning and zoning of the Department of Commerce commenced preparing this standard act in 1924 in response to many requests from municipal and state officials and private organizations interested in civic affairs. The same committee, which was appointed in 1921 by Secretary Hoover, had already drafted a standard state zoning enabling act, which has been used as a guide in drafting legislation adopted in 29 states.

In a foreword to the pamphlet containing the city planning enabling act, the Department of Commerce states:

"A state legislature, in adopting such an act, grants to cities the authority deemed necessary for effective planning and prescribes certain conditions as to planning organization and procedure.

"The advisory committee members have each had many years of first-hand experience in coping with local planning problems, both as local citizens and in connection with the leading national business, professional, and civic groups which they represent. During their three years' work in drafting this act they have made laborious researches into legal problems and have consulted with expert planners, members of planning commissions, municipal officials, and other interested persons throughout the country.

"The report recommends, first, a clearly defined permanent planning branch in the local government, in the form of a commission which formulates a comprehensive plan and keeps it up to date. The commission then advised the legislative and executive branches of the municipality, and the public, as to the importance of the plan and promotes conformance to it in the laying out of new streets, the construction of public works and utilities, and the private development of land. Close attention was given to every detail here, as elsewhere in the act, that would help make good planning popular and effective.

"The sections devoted to control of new subdivisions are framed with careful regard to constitutionality and aim at procedure which will promote harmony and justice in all relations between the planning commission and the private landowner. The part relating to control of buildings in the bed of mapped streets involved much laborious original work on a special problem.

"The portion on regional planning presents the primary need for bodies to study and define regional problems comprehensively as the first step toward solving them. This procedure tends to forestall mistakes and prevent the gradual growth of conditions that may call for hasty, emergency solutions at extra expense. Regional problems should be thoroughly analyzed and publicly discussed before supplementary or new regional forms of government are set up to cope with them."

A limited preliminary edition was issued in March, 1927, and has already been used by the legislatures of California, Maryland and Pennsylvania in framing laws. The printed edition, now published, contains some improvements in phraseology and some revisions in the notes. Footnotes accompanying every section of the act explain in some detail the reasons underlying many of the recommendations and the phraseology used to convey them.

The committee itself makes the following general statement in regard to the act:

"This act covers the four general subjects which experience has shown to be a necessary part of planning legislation, namely, (1) the making of the city plan and the organization and powers of the city planning commission, (2) control of subdivisions, (3) control of buildings in mapped streets, and (4) regional plan and planning commission.

"Sooner or later every state will need legislation covering all of these four general subjects. The text of this act has been so arranged, however, that any state which feels that it does not desire to include the control of subdivisions or buildings in mapped streets or regional planning or any two or three of these subjects can omit the part or parts for which it does not deem itself ready.

"Legislation concerning the three subjects of subdivision control, mapped streets, and regional planning may be said to be in the trial and error stage. By this is meant that practical experience and judicial decisions upon the legislation have not been sufficiently extensive to enable anyone to be dogmatic about the best or final form of legislation on these subjects. The committee believes that it has worked out provisions which represent the most extensive investigation into and the best prevailing thought on the various features. As stated above, each of these subjects is a necessary part of effective planning legislation, and the text of this act supplies, therefore, a model from which to frame and develop the planning legislation of the various states of the country.

"Some states now have upon their statute books measures to which any new provisions on these subjects would need to be adjusted. Some parts of this act, particularly those relating to mapped streets, involve considerations of and adjustments to constitutional provisions relating to eminent domain, and, as these provisions differ in different states, variations of those parts of the text of this act may be requisite in any particular state to adjust this legislation to the privileges and limitations allowed by or imposed by the constitution of that state as interpreted by its courts. Other adjustments to local decisions on constitutional law, local legislative customs, local modes of expression, or local traditions may prove necessary or advisable.

"Consequently, though this standard act has been prepared after careful study of the legal and administrative problems that arise in planning, it is not meant to be slavishly followed to every word, sentence, or section, but rather to be used as a model and to be followed but with such adjustments as may be dictated by local constitutional and statutory law and legislative customs and tradition.

"In the notes are pointed out many of the places where these problems will arise and need to be taken into account in the final form of the enactment."

The advisory committee on city planning and zoning was constituted as follows:

Charles B. Ball (died Oct. 8, 1928), municipal engineer, secretary-treasurer, City Planning Division, American Society of Civil Engineers; Edward M. Bassett, lawyer, counsel, Zoning Committee of New York; Alfred Bettman, lawyer, American City Planning Institute and National Conference on City Planning; Irving B. Hiett, realtor, ex-president, National Association of Real Estate Boards; John Ihlder, housing consultant, former manager, Civic Development Department of the Chamber of Commerce of the United States; Morris Knowles, consulting engineer, from the Chamber of Commerce of the United States; chairman, City Planning Division, American Society of Civil Engineers; J. Horace McFarland, master printer and civic investigator, ex-president, The American Civic Association; Frederick Law Olmsted, landscape architect, ex-president, The American Society of Landscape Architects; ex-president, American City Planning Institute; Lawrence Veiller, housing expert; secretary and director, The National Housing Association.

The publication may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 ct. a copy.

Modern Street Lighting Practice

Comparison of Systems and Intensities Now in Use

By C. E. SCHWENGER
Distributing Engineer, Toronto Hydro-Electric System

ORIGINALLY, streets were lighted so that one could see to go about at night; great intensity of illumination was not an important item. Today, however, streets are not lighted for our personal convenience, but to reduce crime, to reduce accidents, to speed up traffic, to increase civic pride, to stimulate business and other activities, and thereby boom or exploit the city itself.

The change in requirement during the last 15 years is largely due to the entrance of the traffic problem. Before that date automobiles were very few. Today, we have many thousands of cars on our streets at all times. The requirement of the automobile driver for good street lighting is now predominant. In 1910, let us say, when most "Hydro" street lighting systems were being designed, there were practically no automobiles and systems were laid out without this very much in mind.

Lighting System in Toronto.—In Toronto, a system using incandescent lamps, 100 watts, 80 c-p. mounted only 9 ft. 6 in. from the roadway, was adopted. This system was used universally over the city except downtown. This mounting height was due to the necessity for placing the lamps below the trimming heights of the trees on the streets; this trimming height in those days being 10 ft. There were few asphalt pavements and less than 1,000 cars, and glare to the driver was not a large factor. However, provision was made against glare by the adoption of a translucent cylinder enclosing the lamp which is so evident in Toronto today. It soon became apparent that higher mounting heights and greater lamp intensities were needed to take care of the gradually growing traffic. At the present time, the Toronto system uses lamps of 100 c-p. at 12-ft. mounting height for residential sections, and still it is necessary to use the translucent glass cylinder to prevent glare. On main thoroughfares greater intensities are now used and these will be discussed later.

Modern High Intensities.—Modern street lighting practice demands that lamps of increasingly large intensities be used and be mounted at such a height and with definite light control equipment as to prevent glare to the automobile driver on the highways of our cities. There are two general methods of reducing glare, namely, by increasing the mounting height and by the use of diffusing or light controlling glassware, and of course, a combination of these.

Recommendations of Illuminating Engineering Society.—It might be well to lay down at this point a few of the adopted recommendations of the Illuminating Engineering Society, as presented by their committee on "Street Lighting" 1927, to which other engineering bodies have agreed.

1st. Resolved—That there are no conditions of street lighting prevailing in the United States which justify the use of smaller than 1,000 lumen lamps and that the 2,500 lumen lamp is the smallest size which may be used with economy.

Also Resolved—That present day Mazda street lighting lamps rated in lumens are substantially the illuminating equivalents of like types of lamps which previously have been rated in candle power of one-tenth numerical value, e. g., a 1,000 lumen lamp is equivalent to a 100 c-p. lamp.

It is recommended that ratings in candlepower which are now antiquated and in some cases may not be reliable, be abandoned in the few cases in which they still obtain, and that lumen ratings which are now standardized for all series lamps, be adopted in their place.

The "lumen" is the unit of light flux and is that flux of light radiating with unit intensity through a unit solid angle.

Lumen output equals the mean spherical candle power multiplied by 4π (12.766).

Comparison of Lamps.—Now let us compare available street lighting lamps.

Knowing the lumens output of the lamps used on various street lighting systems, a convenient way to compare such systems is to do so on the basis of lumens per foot of street. (This does not take into account the efficiency of light distribution on the street).

Such data do not give a relative comparison of the lumens which usefully reach the street. The amount of useful lumens is dependent on the type and efficiency of the light controlling devices. This may be some property inherent in the lamp itself, such as an arc lamp, which throws most of its light downwards, or on reflectors, refractors, globes or other controlling mediums.

Table I—Comparison of Street Lighting Lamps

c-p.	Type	Watts	Lumens
100	6.6 amps.	69	1,000
250	6.6 "	152	2,500
400	6.6 "	244	4,000
600	6.6 "	361	6,000
600	20 "	330	6,000
1,000	20 "	540	10,000
	120 v. Mazda	100 "B"	980
	" " "	100 "C"	1,260
	" " "	150 "C"	1,950
	" " "	200 "C"	3,100
	" " "	250 "C"	3,750
	" " "	300 "C"	4,840
	" " "	500 "C"	8,750
	" " "	1,000 "C"	18,500

Now as a further consideration let us take for example the case of street lighting systems using 1,000 lumen lamps bare with no control devices. In such a case the light distribution is practically uniform in all directions from the lamp and approximately 50 per cent of the light flux (lumens) is directed downward, i. e., 500 lumens are available as useful light for street lighting. Now using a good refractor we may catch the upward flowing light and re-direct it in a downward direction.

Bare lamps (without control devices) will give less glare if greater mounting height is used, but this is not practical in most cases on account of trees, and where the unit is of very high intensity it becomes necessary to mount the lamps at a height altogether too great for convenient maintenance. A small bare lamp, 1,000 lumens, must be mounted at a greater height than 15 ft. to reduce glare to a reasonable value. Large units such as 10,000 lumens, bare, would have to go at least 30 ft. or more from the ground to accomplish the same results.

On the other hand, lighting units using suitable control devices may be mounted considerably lower without

Table II.—Comparison of Street Lighting Installation

Location of Lighting		Unit Lumens	Spacing	Lumens per foot of street
Toronto:	Yonge St., down-town	8,750 mult.	100 ft.	175
	Sunnyside	6,000 series	"	120
	Danforth Ave.	4,840 mult.	"	96.8
	Residential—Double	1,260 "	"	25.2
	Single	1,260 "	"	12.6
Winnipeg:	Memorial Bldg.	30,000 arc	"	600.0
	Local Improvement	10,000 series	150 ft.	70.0
	Residential	10,000 "	325 ft.	32.0
Montreal:	New system	15,000 "	95 ft.	315.0
Brantford:	Main streets	15,000 "	100 ft.	300.0

Table III—Approximate Efficiencies of Control Devices

Controlling Device	Lamp Lumens Bare	Total Lumens Transmitted	Downward Lumens	Efficiency
Reflector (radial wave)	1,000	866	718	71.8
Refractor (band)	1,000	725	666	66.8
Shaped translucent glassware	1,000	760	412	41.2

producing objectionable glare, thus a 1,000 lumen unit with refractor may be mounted at a height of from 12 to 15 ft., and a 10,000 lumen lamp may be mounted as low as 18 ft. These mounting heights make it possible to illuminate the streets where there are trees, and also to use existing poles or reasonably short ornamental pillars. In addition, still lower mounting heights may be used if good diffusing glassware is used.

These recommended intensities are somewhat higher than are used in most parts of the Province of Ontario.

Table VI gives some idea of the present tendency in various cities to high intensities.

There are two generally accepted types of street lighting systems used, namely, the series system with all lamps on a circuit in series with each other and the multiple system having its lamps connected in multiple on the circuit. There is also a small amount of series multiple lighting.

Table IV—Types and Mounting Heights Used in Toronto

1,260 lumens—100 watt (mult.) radial wave reflector	15	ft.
1,260 " —100 " " diffusing glassware	12	ft.
4,840 " —300 " " " "	15	ft.
8,750 " —500 " " " "	15	ft.
6,000 " —600 c-p. series refractor and disc. glass (Sunnyside)	15	ft.
OTHER INSTALLATIONS		
100,000 lumens, 2,250 watt (mult.) diffusing glassware (Chicago State St.)	22	ft.
15,000 " Luminous Arc. (San Francisco Market St.)	32	ft.
6,000 " 600 c-p. series, Oneida, N. Y., diffusing globe	11½	ft.
6,000 " 600 c-p. series, Allentown, Pa., diffusing globe	14½	ft.
2,500 " 600 c-p. series, Mandan, N. D., diffusing globe	12	ft.

These systems may be installed either overhead with open wire circuits or underground with lead covered cable which may be installed either directly in the ground or in a duct system.

Series System (Ontario).—The series system, as used in Hydro municipalities, has the disadvantage where used overhead of having a small high voltage wire strung from pole to pole and in close proximity to other conductors. The pressure may reach several thousand volts. The multiple system, on the other hand, has a maximum voltage of that of the lamps (120 volts). The series system requires constant current transformers which operate at a comparatively low power-factor as compared to constant voltage transformers supplying a multiple system. The power-factor on the series system is less than 70 per cent as against 95 per cent power-factor on multiple system. This low power-factor practically cancels the advantage the series lamp has, through greater efficiency, over the multiple lamp.

There is not much to choose between the series or multiple system in initial capital costs as constant current transformers are several times the price of corresponding constant potential transformers. This increased cost about cancels the saving in series system where only one wire is used on the multiple system.

While at present there are throughout America a predominating number of series systems, there is a growing percentage of multiple systems being installed, e. g., Minneapolis, Vancouver, Milwaukee, Chicago.

Multiple System.—From an operating viewpoint the multiple system has certain advantages. On such a system as used in Toronto, the loss of a street lighting transformer is handled in an emergency by cutting the multiple network clear of the defective transformer and obtaining temporary supply for the street lighting from the house lighting mains which everywhere parallel the street lighting secondaries.

This flexibility does not exist where the series system is used.

With a multiple system extensions may be made with ease as compared to the series system. A wire break or cable fault is not so likely to extinguish all the lamps as would be the case with series lighting.

Extra business, such as advertising sign loads, traffic signs, danger signals, fire alarm boxes, signal lights, etc., are readily supplied by the multiple system without expensive changes to the existing system. These are difficult loads to handle on a series system.

To give some idea of the business exclusive of regular street lighting, which may be added to the street lighting system, Table VII is given.

Special Type of Street Lighting.—Railway crossings are specially marked by flood lighting arrangement which shows up plainly the tracks and gates, etc.

Traffic police officers are assisted at intersections by means of larger lamps mounted over the center of intersections. This lighting makes the officer plainly visible to motorists.

Street intersections are also sometimes illuminated with larger lamps mounted at the intersections higher than on adjacent poles. This is a decided convenience to automobile traffic.

Another tendency is that on account of traffic requirements the old moonlight schedule for street lighting hours has become obsolete and a sunset, sunrise schedule is almost universally used.

Where shade trees are newly planted along city streets, the street lighting requirement should receive consideration. In Toronto, the practice of the Forestry Dept. is to plant shade trees behind the sidewalks at intervals of 45 ft. No trees are planted within 45 ft. of the street corners. This gives intersections clear of foliage when the trees grow up.

Acknowledgment.—The above is taken from a paper presented at A. M. E. U. Convention at Niagara Falls.

Table V—Recommended Modern Practice

	Type	Lumens per ft. of street
Large cities	Heavy traffic streets	400 to 1,000
100,000 population	Medium traffic streets	200 to 500
or greater	Residential streets	15 to 30
	Alleys	15 to 30
Smaller cities	Heavy traffic streets	300 to 500
	Medium traffic streets	200 to 300
	Residential streets	15 to 30
	Alleys	3 to 8
Small towns	Main business streets	80 to 200
	Residential streets	8 to 15
	Alleys	3 to 8

Table VI—Examples of Street Lighting Intensities

City	Lumens per ft. of street
Cleveland (Superior Ave.)	500
Los Angeles (Broadway)	510
Minneapolis (business section)	520
Portland, Ore. (business section)	600
San Francisco (Market St.)	750
Niagara Falls, N. Y. (Falls St.)	750
Salt Lake City (business section)	820
Chicago (State St.)	2,000

Table VII—Business Added to Street Lighting System for Toronto

	Number
Advertising signs, 500 kw. total load	840
Street traffic signs, detours, quiet zone, No Parking, etc.	127
Private lights—apartment house entrances, courts, etc.	107
Street railway, signal lights for intersections, loops, lavatories, etc.	725
School yard lights (morality lights)	15
Public lavatories	38
Store front lighting, stores	20
Fire alarm signal lights	329

Standard Size of Fields for Games

Rugby Football	225 ft. x 330 ft.
American Football	160 ft. x 360 ft.
Hockey	150 ft. x 225 ft.
Soccer	180 ft. x 300 ft.
Golf Driving Net	12 ft. x 25 ft.
Volley Ball	25 ft. x 30 ft.
Horseshoe Court	12 ft. x 52 ft. (stakes 40 ft. apart)
Baseball	90 ft. between bases, field limits 285 ft.
Tennis	36 ft. x 120 ft.
Handball	20 ft. x 36 ft.
Basketball	50 ft. x 70 ft.
Paddle Tennis	18 ft. x 30 ft.
Outdoor Bowling Green	40 yards square
Each individual rink	19 to 20 ft. wide
Boccie	18 ft. x 60 ft.
Pelota	Stone wall 30 ft. high 55 ft. wide
Ground	55 ft. x 250 ft.

Obtaining Sand from Sludge Bed Area

Sand Washing Plant at Tannersville, N. Y., Works

AN interesting design of sand washing plant was used in the construction of sewerage for the village of Tannersville, N. Y. This work was undertaken for the protection of the New York City water supply in the Schoharie watershed, it purpose being to protect the sanitary quality of the water in Gooseberry Creek, a tributary of Schoharie Creek. The work, the contract for which was let on March 8, 1927, to the Paulsen Construction Corp., 21 East 40th St., New York City, included the construction of a collecting system, house connections, etc., and the building of disposal works of a daily capacity of 420,000 gal., comprising septic tanks, sludge beds, dosing chambers, sand filters and a chlorination plant.

The sand washing plant was installed at the disposal area and consisted in the main of a revolving drum with blank and cylindrical screen sections, three wash boxes, bins for plant product, etc. Run-of-bank sand was dumped on an elevated run-way and fed through a grizzly with bars spaced 5 in. apart to a bucket elevator which operated at a speed of 120 ft. per minute. The elevator discharged into a hopper which was supplied with water through three ¾-in. pipes and one 1½-in. pipe and delivered the sand to a revolving drum 48 in. in diameter which was divided into three sections. The first section, 6 ft. in length, was blank and carried blades similar to a concrete mixer; the second section was a screen section of ⅝-in. mesh and 8 ft. in length, enclosed in a ¼-in. sand jacket for the first 7 ft. of its length; and the third section comprised a screen section of 2-in. mesh, 6 ft. in length. The drum revolved at a rate of 13½ revolutions per minute.

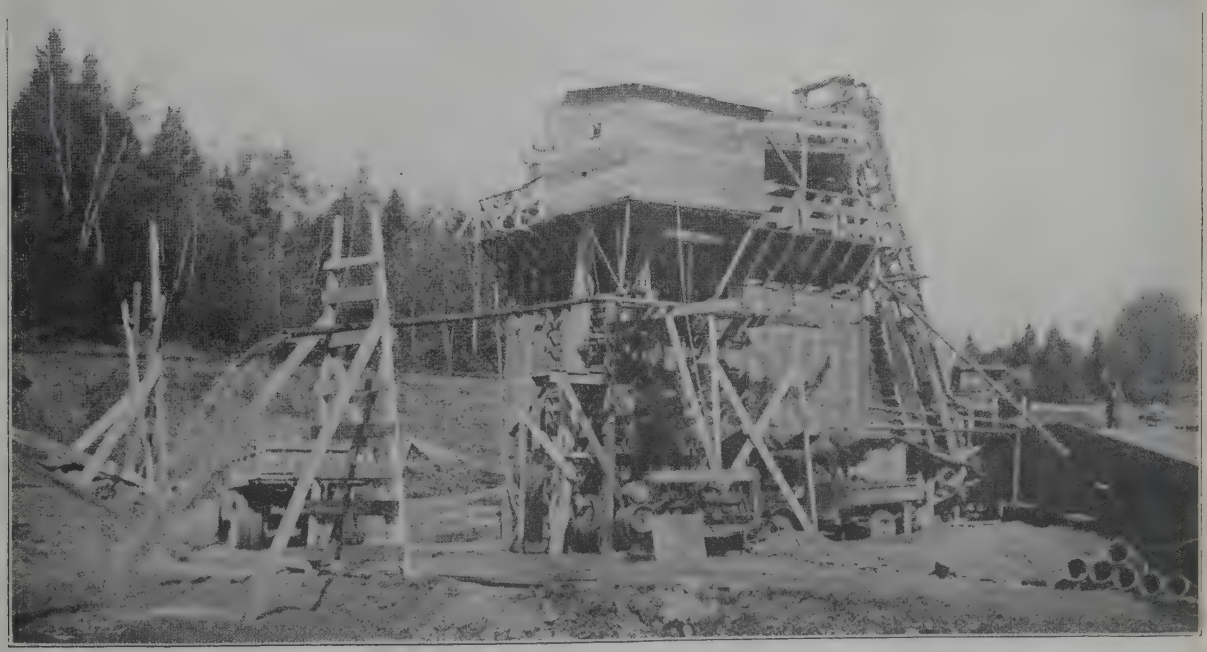
Water was applied both inside and outside the drum, an axial pipe, 2½ in. in diameter, supplying water to the inside of the blank section through ten equi-spaced $\frac{5}{16}$-in. nozzles and to the ⅝-in. screen section through fourteen equi-spaced ¼-in. nozzles. Water was supplied to the outside of the sand-jacketed ⅝-in. screen section by a 2-in. pipe with thirteen ⅛-in. nozzles. The mixture of sand and water passing through the ¼-in. sand jacket fell into a hopper under the screen and was thence delivered by a chute to the first wash-box or scrubber. The gravel passing the ⅝-in. and 2-in. screens and the tailings were delivered by chutes to bins below.

The scrubber was a long narrow box with an inclined bottom in which a chain, with metal blades attached, pushed the sand up the incline and delivered it to the upper end of the second wash-box. The major portion of the conveying water and its fine sand content were wasted from the lower end of the scrubber.

The second wash-box was 10 ft. long, 2½ ft. wide and 1½ ft. deep at the upper end and 3 ft. 1 in. at the lower end, and water under pressure from three lines of 2½-in. perforated pipes located at the base of the box was forced up through the sand. The agitation produced by this forced water feed caused the heavier sand particles to travel by gravity along the bottom of the box and thence through a 3-in. discharge pipe to the third wash-box, while the lighter sand particles were carried in suspension and discharged with the washwater through a trough 7 ft. long by 8 in. wide, with a sloping bottom, located in the center of the wash-box at the lower end.

The third wash-box was made in the form of a truncated pyramid 2½ ft. deep and had top and bottom dimensions of 4 ft. 9 in. and 1 ft., respectively, the function of this box being to further reduce the percentage of fines in the sand.

From 600 to 800 gal. per minute of wash water were used during the operation of this plant. Up to Dec. 31, 1927, a total of 15,880 cu. yd. of run-of-bank sand was delivered to the washer and the resultant output was 6,400 cu. yd. of washed sand, 5,510 cu. yd. of gravel and 3,970 cu. yd. of waste and tailings.



Sand Washing Plant, Installed in Sludge Bed Area at the Disposal Works of Taylorsville Sewer System

Development of Regional Planning

An Outline of Progress in Canada

By J. CLARK KEITH
Chief Engineer, Essex Border Utitlities Commission, Windsor, Ont.

PROGRESSIVE communities have not been slow in realizing that they must put their affairs in order. There are 529 cities in 44 states of the United States which have city planning boards or commissions. In Ontario, insofar as I can ascertain, city planning commissions have been appointed or created in only eight communities—London, Kitchener, North Bay, Hamilton, Niagara Falls, Ottawa, Toronto and the Border Cities. This is not an indication that the need for them does not exist. On the contrary, the presence of such a body when actively functioning is an asset whose value in dollars and cents is not measurable to any growing community. Any city which is prepared to allow the future to care for itself tacitly admits that as a national asset it must be rated extremely low. Money spent on city planning, either for the correction of past errors or for sane future growth is not a speculative investment. No city body can be accused of speculating if it takes steps to provide for the welfare and health of its inhabitants. It should, on the other hand, be guilty of remissness if it loses opportunities for so doing, opportunities which may never recur.

City Planning a Misnomer.—City planning has come to be more or less of a misnomer. The essence of planning is to provide for expansion. The planner is more interested and has greater opportunities in the comparatively undeveloped areas in or adjacent to the city than in the well established sections. His field is as much outside the city boundaries as it is within them, and this is particularly true of metropolitan areas dominated by one great city.

It may be stated as a truism that the effect of the city upon its adjoining suburban area is no more pronounced and probably less so than that which the suburban areas may later have upon the city. From time to time, those areas would automatically become annexed to the city. This is not the trend of present day sentiment. Annexation as a means of providing civic amenities is giving way to regional government. There has been but one example in the twentieth century of a great city extending its boundaries to include numerous pre-existing municipalities—the creation of Greater Berlin in 1920. It required all the pressure of post-war necessity, plus a tradition of subordination to central control to bring this consolidation to pass. At that, it had to be accomplished by the devolution of extensive powers to divisions of the metropolis.

Prior to the advent of the motor car, suburban development clung closely to the city boundaries. Latterly, rapid transit enabled suburban communities to develop at greater distances from the city's center. The average commuting distance in Chicago today is stated to be fourteen miles. For a generation preceding the inter-urban electric, the steam railroads furnished the transportation and the suburbs were strung along these in a continuous chain. The electric lines and more recently, the automobile and motor bus, have enabled inter-spaces to develop, substantially suburban in character. Annexations have thus been retarded in recent years. The increasing necessity of thinking of and dealing with urban affairs in terms of metropolitan regions rather than as incorporated municipalities is now admitted without question.

Utilities and Regional Planning.—The planning of a regional area does not consist solely in laying down a network of major and minor highways, no matter how complete it may be in itself. It should make provision for such factors as water supply, sewage and sanitation, recreation facilities, parks and park systems, education, zoning, sanatoria and related health matters, rapid transit, aeronautics, cemeteries, harbor or water front development, etc.

If regional planning is to be undertaken, there does not seem to be any justification for the creation of innumerable commissions or boards to carry out the varied phases of regional development. Where two communities endeavor through a single agency to solve some problem which affects them jointly or in which they have a common interest they have touched some phase of regional planning. We have been prone to think of planning in terms of streets and highways, but surely health, water systems and sanitation are equally as important. How attractive would a model system of transportation be to any citizen if nothing else were provided? Each of us knows that if some minimum standard of water supply and sanitation could be insisted upon in the indiscriminate subdivision of land around every metropolis, that it could be hailed as a millenium in civic expansion.

What Regional Planning Accomplishes.—A regional planning disregards political boundaries and includes that large adjoining territory already a part, socially and economically, of the central city. Regional planning is not a program for spending vast sums of money. It seeks to insure the greatest return in the future for money wisely expended today. The outlying areas merely constitute a reservoir into which the surplus population from the center may overflow. The citizen of today, irrespective of his station in life, no longer wants to be a pioneer. He wants the same comforts in life for himself and family in his new surroundings that were provided in the old. He will expect some beneficent municipal government to provide him with water sanitation, recreation, education facilities, etc. How can these be secured unless there is a legally constituted body whose duty it is to see that every citizen has a chance to live decently and in comtfort?

In Canada the majority of water supply systems are municipally owned and newly developing areas are saved from competition and paralleling of lines where several companies might be seeking new business. Efficient sewage disposal is expensive and sometimes beyond the financial reach of small communities or sporadic developments. Economy, efficiency and health are served by the pooling of interests. The preservation of creek valleys as an adjunct to proper sanitary control or for park development purposes can be secured only through the adoption of a single plan for the district. The increasing densities of population require that schools under different jurisdictions be located with definite relation to each other and to a shifting school population. It is not a chance happening that places large centers of population where water transportation is available. A study of any portion of the world's map shows few large cities which have not direct access to the sea. Port problems are essentially regional in character and can be attacked efficiently only by regional action.

Regional planning as an adjunct to a city's future is not only highly desirable, but an absolute necessity. A safe guide in the proper limitation of the scope of a regional plan is to confine it to those functions which do not begin or end within a single municipal jurisdiction. It is founded upon the idea that it is economically more sound and equally in the interests of both that the larger city and its environs or satellite areas be planned as a unit. As yet we have few large cities in Canada but we will have them within the life time of many now concerned with present day problems. There is a limit

beyond which a city cannot grow to advantage or manage its affairs efficiently or economically. The larger the unit, the further government is removed from the people. Popular interest declines in direct proportion to this distance, up to the point where the appeal of national politics begins to take effect. Analysis of the various alternatives offered for the solution of the regional problem seems to lead to the conclusion that there should be a single authority for the region.

The Regional Plan.—There are two essentials to the preparation of a regional plan, first, effective legislative authority whereby the powers which each municipal entity might possess individually may be vested in a single authority; and, secondly, the wholehearted interest and untiring support of the citizens affected. Several municipalities may be faced with a definite problem requiring solution which can be effected only through special legislation. The first powers secured may provide for nothing beyond the immediate problem, but if it has been successfully executed, then the field for further activities is broadened immediately.

The first regional planning commission in the United States was created in Los Angeles as recently as 1923. Other cities where regional control is in effect or in contemplation include Philadelphia, Boston, New York, Pittsburgh, Chicago, San Francisco, Cleveland and Baltimore. Legislation for regional planning or for any particular phase of it cannot be standardized.

Metropolitan District Boards.—Insofar as I am aware there are only five commissions in Canada having jurisdiction in metropolitan areas. These are the Greater Vancouver Water District, the Vancouver Area District Joint Sewerage and Drainage Board, the Greater Winnipeg Water District Board, the Montreal Metropolitan Commission, which exists solely for the purpose of financial control, and the Essex Border Utlities Commission. There are other bodies, such as the Niagara Falls Park Commission, the Ottawa Improvement Commission, and the Quebec Streams Commission, which have been created by the state, but the first five enumerated have been formed at the request of interested municipalities having problems in common. All planning commissions in Ontario have control of subdivisions over a region extending three miles beyond the municipal limits in the case of towns and five miles from cities and in this sense only have the jurisdiction in regional areas.

The activities of three of the foregoing commissions are farily well defined and limited in their appelation to water supply and drainage. The Montreal Metropolitan Commission, made up of representatives of the local units involved, has the power to approve or disapprove the loans of any of the municipal entities concerned with the exception of Montreal itself. If, for example, the city of Outremont wishes to borrow money and the commission approves, the bonds of the Metropolitan district are issued and Outremont must levy taxes to recoup the commission for its assumption of the bonds. The success of this commission has sugested the extension of this principle to the general development of the whole area. Since the sixteen municipalities, of which Montreal is the center, have very real general interest which cannot very well be looked after without some form of coordination, it is probable that some measure will soon be granted by the Quebec Legislature.

Essex Border Utilities Commission.—The Essex Border Utilities Commission is the outstanding example in Canada of an organization created by the Legislature to deal with regional problems. Fronting on the Detroit River in Essex County, seven incorporated municipalities lie side by side without any apparent municipal division. These communities, with two adjacent townships, had common problems which could be solved efficiently and economically only through co-operation. The need of an organization to meet these conditions was recognized and the Essex Border Utilities Commission was formed in 1917. Constituted originally to deal with the related problems of water supply and sewage treatment, the commission has had its activities broadened to include the powers of a board of health, a parks board and a city planning board. The commission consists of twenty-one members, two from each of eight municipalities and five from the city of Windsor. In each case the mayor or reeve constitutes one representative from the community, while the others are elected for a period of three years. Thus the commission is entirely responsible to the electorate and its members serve without remuneration. Two members have been on the commission for eleven years and several others from five to ten years. The general overhead expense of the commission, such as office expense, clerical help, etc., is met by the various municipalities in proportion to the number of its commissioners on the board. All capital expenditures are met through debentures issued by the commission on the credit of and in proportion to the benefit which each municipality derives.

Since its inception, the commission has constructed intercepting sewers at a cost of $400,000, a filtration plant serving all municipalities at a cost of $1,140,000, a metropolitan general hospital costing $560,000, and is now engaged on a general plan covering waterfront development and further sewerage extensions which will cost from three to five milion dollars. These are tangible evidences of regional co-operative effort, but the most valuable activity of the commission has been in the preparation of a plan of main highways and boulevards to serve the future needs of the district. In less than two years time the highways through Essex County will carry heavier traffic than any other roadways in Canada. A definite plan was prepared almost six years ago, which was described and reproduced in the journal of the institute in June, 1924. With very minor alterations that plan has been the framework around which the newer sections have since been developed. All subdivision plans of the district must pass through the hands of a special committee of the commission before they can be registered. During the past eight years upwards of 300 plans have been dealt with, and at least 75 per cent of them were modified in some manner for the betterment of the district. The newer sections of the Essex Border District are not going to be faced with expensive corrective undertakings in the future. The area involved in planning studies covers about 125 square miles.

When an effort is being made to control and direct the development of a district, it is a source of irritation when something occurs which may tend to undo any part of the work that is being done. In the hope that the experience of other communities may be related at this gathering, reference is being made to the question of cemeteries. The relation between the city of the dead and the city of the living is an important problem in present-day planning. Like all other established physical elements of a city, the cemetery must be provided for and must be given that consideration which will permit it to function with the city and do as little harm as possible to it. The location of a cemetery has in many instances interfered with the best and most logical community growth. It is true that there is hardly a large city which has not witnessed the destruction of one or more of its cemeteries, yet once established it stands as a grim sentinel against the demands of urban growth. As a general proposition, a cemetery should be located away from industries and from the lines of common carriers, but should be in line with the city's residential growth but as far as possible from the existing housing. Neither should they be reached by, nor have their entrance from a highway bearing heavy traffic. In Ontario the location of a cemetery must first be approved by the municipality in which it lies and then by the Provincial Department of Health. Unfortunately the plan for a cemetery does not have to be registered and for this reason city planning boards have no control over them if they are outside the city limits but within the city's urban zone. Two cemeteries were recently located adjacent to Windsor for speculative sale on a highway which will be the main traffic artery of the district.

Acknowledgment.—The above paper was presented by Mr. Keith at the annual meeting of the Town Planning Institute of Canada.

Billing and Collecting Methods Used at Brainerd, Minn.

By W. D. McKAY

Secretary Water and Light Department, Brainerd, Minn.

IN the October issue of Municipal News and Water Works, I find an article by W. D. Stalker on "Time Saving Methods in Billing and Collecting."

Some six years ago or more I introduced a system which has worked very satisfactorily. It saves the expense of mailing bills to our customers, and in addition gives them the amount of their bills, as soon as meter is read.

The city has both water and light plants, and both meters are read at the same time, which is done monthly. There are about 5,000 meters, and two readers require about 21 days each month to read them. Our city is 100 per cent metered.

Blank No. 1 is used by the readers,

ORIGINAL

Water & Light Dept. Nº 9107

CITY OF BRAINERD

Date of Reading.....8/22/28..192.

Present this at the Office of the Secretary when payment is made
Office Hours: 8 A. M. to 5 P. M., except Paydays,
when Office is open to 8 P. M.

Name ...J. Jones.....

Street and Number .....324 N 8thst.....

METER READING

CLASS	READINGS		CONSUMPTION	AMOUNT Dollars	Cts.
Light	Present	2647			
	Previous	2617	30	1	95
Water	Present	280000			
	Previous	276900	3100	1	55
Heat	Present	1552			
	Previous	1500	52	1	56
Power	Present	1000			
	Previous	260	740	10	40
Sprink'g	Present				
	Previous				
		Total		15	46
		Penalty			
		Total			
		Adjustment			
		Total			
		Paid on Account			
		Balance			

NOTICE

Rules and Regulations for Customers

All rentals are due and payable at the office of the Secretary before 20th day of month following reading.

If rentals are not paid when due, a penalty of 10 per cent will be added and the city reserves the right to discontinue service without furher notice.

Parties moving into premises must report at once to the office of the Secretary, so that meter readings can be taken, and also ascertain whether previous month's rent has been paid, otherwise they will be held liable for said rent.

It will be appreciated if Office is notified of any leaks in streets or of any Arc Lights out of Commission.

Rules and regulations governing the system are printed and a copy will be furnished on application if you have none.

Blank No. 2

and is filled out at once and left with the consumers. They have a ready table to make it from, thus avoiding errors. The meter books are audited before bills, as shown in Blank No. 2, are made out from them in duplicate. These bills are filed in a cabinet in street and numerical order, so that customers can be handled very promptly, as it simply requires stamping date of payment. One of these bills is original, the other a duplicate, with perforation between. They are not separated until payment is made. The duplicate is used for our Consumers' Register. Frequently before we used this system, claims would be made that the consumer had paid the previous month, but when we had the original that was evidence enough to know, without any further reference, it had not been paid. These duplicates are a great means also of determining our delinquencies readily, and aid very materially in our trial balances.

Reading water meters monthly enables us to keep in close touch with their condition, as we own all meters.

Water and Light Department

CITY OF BRAINERD

Telephone 66

Date of Reading_____192

Present this at the Office of the Secretary when payment is made.
Office Hours: 8 A. M. to 5 P. M. except
Paydays, when Office is open to 8 P. M.

Name_____

Street and Number_____

METER READINGS

Class	Readings	Consumption	Amount Dollars	Cts.
Light	Present Previous			
Water	Present Previous			
Heat	Present Previous			
Power	Present Previous			
Sprinkling	Present Previous			
	Total			

NOTICE

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It will be appreciated if Office is notified of any leaks in streets or of any Arc Lights out of Commission.

Rules and regulations governing the system are printed and a copy will be furnished on application if you have none.

Blank No. 1

Schedule of Water Rates

All consumers up to 40,000 Gals, 50c per 1,000 Gals. From 40,000 Gals. up to 100,000 Gals. $20.00 per month minimum.
Over 100,000 up to 199,000 Gals. per month, 18c per 1,000 Gals.
Over 199,000 up to 299,000 Gals. per month, 14c per 1,000 Gals.
Over 299,000 up to 399,000 Gals. per month, 10c per 1,000 Gals.
Over 399,000 up to 700,000 Gals. per month, 8c per 1,000 Gals.
Minimum, 75 cents per month.

Sprinkling Rates

Sprinkling rates are governed by the April reading, and run continuously for five months. All used during this time in excess of April reading will be 10c per 1,000 Gals. Minimum of 1,500 Gals. per month for 75c. Sprinkling only applies beyond consumption of 1,500 Gals.

Electricity Rates

Light 6½ cents per K.W.H.
Power—First 500 K.W.H., 4 cents per K.W.H.
Power—Next 250 K.W.H., 3½ cents per K.W.H.
Power—All over 750 K.W.H., 3 cents per K.W.H.
Cooking—3 cents per K.W.H.
Minimum for Light, 75 cents per month.
Minimum for Cooking, $1.00 per month.

Minimum on Power

$1.00 per H.P or fraction thereof up to 5 H.P 25c per H.P or fraction for all over 5 H.P

Back of Blank No. 1

Administrative Problems of Sewerage

Interesting Discussion of an Important Subject

By P. F. HOPKINS
City Manager, Mason City, Ia.

THE fact that sewers are buried in the ground out of sight and sewage treatment plants are usually in more or less out-of-the-way locations tends to create a lack of public interest in them. There is, too, an innate dislike in the average person's mind for the whole subject of sewerage. This attitude on the part of the public undoubtedly is reflected in the official tendency to be slack in the administration and care of sewer systems and sewage treatment plants, and to do only that which is absolutely necessary for their operation. The householder is not concerned with the sewer in his street so long as it takes care of his wastes; he never sees it and it never bothers him, except in rare cases when it becomes clogged. On the other hand, he can see any defect in the surface of the street, and since its condition is important to him every day, he is not slow to complain when it needs attention. The sewage treatment plant is rarely visited by anyone but those responsible for its care, and even if it were visited, most people would expect to find a smelly, unsightly place and would not realize that such a condition might be due to improper care in operation.

Minimum Appropriations for Sewage Maintenance.—The net result of all of this is that nearly all administrators reduce the expense of sewage operations to a minimum and do just what is necessary to keep sewer systems open and treatment plants from getting too objectionable. Money saved in this way can readily be allocated where the public can see the results—and we never have sufficient funds to satisfy the demands for our citizens for street work and similar services.

I do not mean to give the impression that we deliberately set out to neglect our waste disposal utilities, but we are all human, and we are likely to take care of those things which cause the most complaints, to the possible neglect of those which are not bothering us.

Sewerage Maintenance in Smaller Cities.—It can be truthfully said that the limiting factor in all municipal activities is the amount of available funds. If that were not true it would be a simple matter to administer a city's affairs. But since it is true, we are always on the lookout for ways to hold down operating costs. Only in the larger cities are we likely to find a separate sewer department whose first duty is to see that the sewers are properly inspected and maintained. Every town has some organization for handling street work, and it is quite common practice to delegate to the street department the maintenance of the sewers. There is no real objection to this way of handling the work, and many reasons for such an arrangement, provided it is not permitted to degenerate into just a case of handling complaints and stoppages. The average workman does not relish sewer work and probably has little conception of the sewer layout or the real function of the system. It is best, therefore, to select a few men who are intelligent and conscientious workmen who can be relied upon to do the actual work under proper direction. Pay them a little extra because of the nature of the work. They will soon develop what might be called the "technique" of clearing stoppages. They should be equipped with good sewer rods, plenty of hose, and various devices and tools for meeting any condition. It is just a foolish waste of money to send men out to do any kind of work without the proper tools. It is best to assemble all of this equipment on a special truck or wagon, so that when they are needed no time will be lost hunting for them, and when the trouble is located the tools needed will be there. Unless a crew is properly equipped and intelligently directed, more time can be wasted and useless work done in clearing a clogged sewer than in any other housekeeping function of the city—and in the meantime maybe a block or two of basements are being flooded. And if the tax payer sees the gang aimlessly prodding away while his basement fills up, he is likely to judge the whole city administration by the way this particular job was handled; and it is surprising how long he will remember it.

Importance of Systematic Inspection.—No sewer system was ever constructed which did not at some time need attention. Systematic inspections will reveal tendencies to clog which can be quickly and easily cleared at this stage but which would mean a real job if the sewer becomes entirely clogged. After the system has been checked a few times, it will be apparent where the stoppages are most likely to occur. These places can be given a little more frequent attention. Dead ends, new sewers with few connections, garages, wash racks, tree roots—all are frequent contributors to sewer stoppages.

It doesn't matter just what the organization for sewer maintenance work is—each town or city may handle it differently—just so someone competent is made responsible for the work. The city engineer, where available, is the logical man to have control over the sewer system and disposal plant. His knowledge of hydraulics, of the layout of the sewer system, and of sewage treatment cannot be duplicated in the ordinary workman. He will analyze the causes of the troubles and will take the necessary steps to prevent a recurrence. He realizes the danger of allowing untrapped garage wastes and wash racks to go into the sewers; he knows that roof drains and cistern overflows will overload the sanitary sewers, and will be able to detect the prevalence of these in any section; he knows how to keep records and how to interpret them.

Value of a Spot Map.—Reports on sewer maintenance work need not be elaborate. Location of trouble, probable cause, any pertinent comments, and the cost of clearing, are sufficient. I am a believer in the value of visual records. A spot map showing the location of all sewer stoppages during the year may tell something that would not be apparent otherwise. You will be surprised at the number of repeaters. The removal of the cause will save you trouble and money.

Plant Operation Reports.—It is obvious that a plant operator must be a man of sufficient intelligence and dependability to take these records and, from them, to judge the plant's operation. In addition to the records that indicate the efficiency of the plant operations, the administrative official wants also such records as will tell him how much sewage goes through the plant, individual pump performance and current consumption where pumping is necessary, labor costs, frequency of sludge withdrawals, and the approximate quantities, when and why sewage is bypassed, when and why tanks foam and filters clog. He probably knows the daily water pumpage of the city which has a direct relation to sewage flow and will be able to detect any unusual relationship between this pumpage and sewage flow.

Periodic Supervision by Outside Engineers.—For the smaller towns which do not have technical advice available, it would be wise to arrange for periodic supervision by some competent engineer who can check up on operating conditions and advise your operator how to get results. This will not be beyond your financial resources and will save you money in the long run. The time required for such checkups will be ma-

terially shortened if reasonable records are available. Aside from the actual value of good operating records, there is a bit of practical psychology in requiring an operator to write down each day certain facts concerning his plant. He is not going to continually put down in writing statements of plant conditions which he knows should not exist. The chances are that he will take the necessary steps to correct them and will soon take pride in being able to truthfully record "all's well." On the other hand, if there is no daily log of the plant, it is quite easy for him to contend that the bad condition "just got that way lately."

Viewpoint of the Administrator.—Just a word or two in closing from the viewpoint of the administrator: He appreciates a neat appearing plant that is operating well—one that he can feel safe in showing to visitors without having to find some excuse for the conditions found. He appreciates, too, the employee who has the initiative to see the things that should be done without waiting to be told to do them; who comes with constructive suggestions for ways and means for bettering the operations for which he is responsible, and who can back up his requests for equipment or improvements with concrete facts and arguments that will justify the outlay required. The employee must, of course, realize that his requests are only a part of many requests from other departments, all calling for the expenditure of funds. It is the administrator's duty to weigh these requests as to their relative importance. Rarely can he grant them all; available funds again will limit his ability to provide.

It is standard practice in Iowa to special-assess the cost of street sewers to the benefited property. Some cities may have conditions which make the cost of sewers far beyond the $3 per foot which by statute may be assessed. This means that the deficiency must be made up by the city. The cost of sewage treatment plants is great. The millage permitted by law will not always finance this cost and amortize it within the probable useful life of the plant. How and where to legally find the necessary funds is not the least of the administrator's problems connected with the important and vital function of caring for a city's sewage.

I have tried thus briefly to suggest to you some phases of this problem which are always present but which you, in your capacity as operators may overlook, with the thought that you may be helped to see your work as only a part of the whole city's housekeeping; and that you may appreciate the administrator's viewpoint when he does not always provide the things which you feel so necessary.

Acknowledgment.—The foregoing paper was presented by Mr. Hopkins at the recent Sewage Disposal Short Course at Iowa State College, Ames, Ia.

Floral Clock a Park Feature

By GEORGE W. THOMPSON
General Manager, City of Westmount, Canada

The floral clock illustrated on this page is the only one of its kind in Canada, and there are very few in the world. There is one at Edinburgh, Scotland, one in England, one in Belgium and one in Switzerland.

The floral clock was suggested by the then mayor of Westmount, Mr. P. W. McLagan in 1926, and designed by Mr. John McCreath, head gardener of Westmount parks in collaboration with Mr. Geo. W. Thompson, who designed the electrical mechanism for operating the clock.

The flower bed for the clock is 21 ft. square and it is placed on a sloping elevation with a 2-ft. grade and a low open fence surrounds the clock.

Fifteen thousand plants have been used for the clock and setting, these being arranged in beautiful ornamental design. The minute hand is 8 ft. long and the hour hand 6 ft. long. Made of wood with tin sides, they are designed to hold hundreds of plants. Both arms have an outside border of Mesembryanthemums, with an attractive center setting of tall red Alternantheras and Echeverias, including a pivot effect by an Acalphya plant.

In the center of the bed is a 3-ft. ring of Dedum. A twisting rope of Santolina plants features the next circle, with two kinds of red Alternantheras on each side, plus an outer ring of Echeverias and red Alternantheras. In the third circle are the numerals of the clock; these are of red on a background of yellow Alternantheras. The yellow plants will be kept clipped v the red will be permitted to higher.

Just outside the numeral circle bordering ring of Alternantheras Echeverias, while two more rings added for decorative effect. On outside border is a square frame consisting of several rows of A nantheras, golden Privet and Lobelia. At each of the four cor an effective design of tropical flo is arranged, including Dracaena, danus, Centaurea and Lobelia. elevation slopes away in a green effect.

There is an inscription in flower the bottom of the clock, "Ten Fugit." A spot light illuminates clock at night.

New Municipal Airport for Ci nati, O.—It is now hoped that the municipal airport of Cincinnati, O., be ready for dedication next year. equipment will include a two-s administration building, which house the offices of the muni officials in charge of the field, and offices of the Embry-Riddle Comp the present commercial operator Lunken field, who are responsible large measure for the field's dev ment. The administration building also house waiting rooms for sengers. In addition there will be buildings housing a pilots' roo restaurant, hangars and other n sary quarters. Ample lighting facil will be provided, which will include lamp changing flood lights of 1 watts each, a ceiling light, be lights, etc.

Floral Clock Located in Park in Canadian City

The Asphalt Paving Conference

Program of 7th Annual Meeting, New Orleans, December 3-7

n excellent program has been pro-
d for the 7th annual asphalt pav-
conference which will be held Dec.
at the Roosevelt Hotel, New Or-
s, La., under the auspices of The
halt Association, J. S. Helm, presi-
, and The Association of Asphalt
ng Technologists, L. M. Law, presi-
. The advance program follows:

MONDAY, DECEMBER 3rd
Registration
Lobby of Roosevelt Hotel

Special Notice

o day sessions of the asphalt pav-
conference have been scheduled for
day, but all registrants are cordi-
invited to attend a meeting in the
sevelt Hotel at 10:30 o'clock A. M.
2 o'clock P. M. of the South Cen-
Division of the National Highway
fic Association, A. H. Blanchard,
ident.

nformal Open House Reception
Special Features
Roosevelt Hotel
8:30 o'clock P. M.
Tip Top Inn, Twelfth Floor

TUESDAY, DECEMBER 4th
irst Session, 9:30 o'clock A. M.
Tip Top Inn, Roosevelt Hotel
rman: J. S. Helm, President, The Asphalt Association
Address—J. S. Helm, President of The Asphalt Association.
Address—L. M. Law, President of the Association of Asphalt Paving Technologists.
Address—Hon. Huey P. Long, Governor of Louisiana.
Address—Hon. A. T. O'Keefe, Mayor of New Orleans.
Address—Hon. O. K. Allen, Chairman Louisiana State Highway Commission.
Address—Hon. John Klorer, Commissioner Public Property, New Orleans, La.
The Eonomics of Asphalt Pavement Construction as Affected by Mechnical Equipment and Operation," by T. Warren Allen, Chief, Division of Management, U. S. Bureau of Public Roads.
The Economics of Asphalt Pavement Construction as Affected by Materials and Control Methods," by H. M. Ulman, Assistant Engineer of Materials, Pennsylvania State Highway Department.

rnoon Boat Trip on Mississippi River and New Orleans Harbor
New Orleans Refining Company, Host
Party will leave Roosevelt Hotel at 12:45 o'clock P. M. Luncheon will be served on boat.

Parallel Sessions 8:30 o'clock P. M.
I. Second Session, Asphalt Paving Conference
Room E. Mezzanine Floor, Roosevelt Hotel
Chairman to Be Announced

1. "The Airplane in American Commerce and Industry," by Col. Harry H. Blee, Chief Airport Section, Office of Aeronautics, U. S. Department of Commerce.
2. "Asphalt Construction and Treatment for Airport Runways," by A. H. Blanchard, Traffic Control and Airport Runway Consultant, Toledo, Ohio, Member National Aeronautic Society of U. S. A.
3. "Soil Investigation and Subgrade Treatments," by F. H. Eno, Research Professor, Highway Engineering, The Ohio State University; Chairman Advisory Board on Highway National Research Council.
4. "Waterproofing and Stablizing Subgrades with Asphalt Treatment," by C. A. Hogentogler, Highway Engineer, U. S. Bureau of Public Roads.
5. "The History of Black Base Pavements in Fresno County, California," by Chris P. Jensen, County Surveyor, Fresno County, California.
6. "Requirements for Asphalt Filler for Brick Pavements," by Harry J. Kirk, Director of Highways, State Highway Department, Columbus, Ohio.

Discussion—Bryson Vallas, City Engineer, New Orleans, La.

II. Association of Asphalt Paving Technologists
Business Meeting for Members
Room C. Messanine Floor, Roosevelt Hotel

WEDNESDAY, DECEMBER 5th
Third Session, 9:30 o'clock A. M. on Service Results from Use of Asphalt in State and Provincial Highway Construction
Tip Top Inn, Roosevelt Hotel
Chairman to Be Announced

1. "Service Results in Michigan," by V. R. Burton, Engineer of Research and Statistics, Michigan State Highway Department.
2. "Service Results in Georgia," by W. R. Neel, State Highway Engineer, Georgia.
3. "Service Results in Massachusetts," by V. L. Ostrander, Manager, Eastern Branch, The Asphalt Association.
4. "Service Results in Ontario," by R. M. Smith, Deputy Minister of Highways, Ontario Department of Highways.
5. "Service Results in North Carolina," by John D. Waldrop, Assistant Highway Engineer, North Carolina State Highway Commission.
6. "Service Results in Tennessee," by T. C. McEwen, Chief Engineer, J. E. Moreland, State Construction Engineer, and F. W. Webster, State Maintenance Engineer, Tennessee Dept. of Highways and Public Works.
7. "Service Results in Louisiana," by Major James M. Fourmy, State Highway Engineer, Louisiana.

Afternoon Entertainment Feature
Races at Jefferson Park
Standard Oil Company of Louisiana, Host
Races start at 2:15 o'clock P. M.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS
Technical Session, 8:30 o'clock P. M.
Gold Room, Mezzanine Floor, Roosevelt Hotel
Chairman: L. M. Law, President, Association of Asphalt Paving Technologists

a. Committee Reports.
b. Papers on Recent Research.

THURSDAY, DECEMBER 6th
Fourth Session, 9:30 o'clock A. M.
Tip Top Inn, Roosevelt Hotel
Chairman to Be Announced

1. "Opportunity and Obligation of the Petroleum Industry in Developing the Use of Cut-Back and Other Asphaltic Products for Surface Treatment and Low Cost Roads," by E. W. James, Chief Division of Design, U. S. Bureau of Public Roads.
2. "A Survey of Prevailing Practices in Connection with the Use of Cut-Back Asphalts and Other Surface Treating Materials," by Herbert Spencer, Standard Oil Company of New Jersey; S. A. Montgomery, Standard Oil Company of Indiana; J. N. Byrd, Mexican Petroleum Corporation.
3. "Methods and Trend of Practice in the Use of Soft Asphalt Cements for Surface Treatment," by Major Charles A. Browne, Chief Engi-

neer, Department of Hard Surface Roads, Orange County, Fla.

Discussion—A. M. Lewis, Arkansas Lime Products Company.

4. "Methods and Trend of Practice in the Use of Cut-Back Asphalts and Road Oils for Surface Treatment," by H. G. Nicholson, Engineer, Minnesota State Highway Department.

Discussion—Maj. E. R. Taylor, Chief Engineer, General Construction Co., Vancouver, British Columbia.

5. "The Economics of Conserving Our Investment in Existing Highways," by Professor H. J. Hughes, Dean of Harvard Engineering School.

Fifth Session, 2 o'clock P. M. on Applied Paving Research
Tip Top Inn, Roosevelt Hotel
Held Under the Auspices of the Association of Asphalt Paving Technologists
Chairman: L. M. Law, President, Association of Asphalt Paving Technologists

1. "Research and Practical Experience," by A. W. Dow, Chemical Engineer, New York, N. Y.
2. "Practical Application of the Shear Test," by H. W. Skidmore, President, Chicago Paving Laboratory, Chicago, Illinois.
3. "Practical Application of the Stability Test," by Prevost Hubbard, Chemical Engineer, The Asphalt Association.
4. "Practical Value of Research as Applied to Paving Problems in Pittsburgh," by J. J. Paine, Director Pittsburgh Bureau of Tests.
5. "Value of Research to the Asphalt Paving Contractor," by Paul M. Wells, Laboratory, City and Contracting experience, Toledo, Ohio.

For the Ladies
Bridge and Luncheon
Orleans Club, 10:00 o'clock A. M.
Followed by Drive Through Old French Quarter
Mrs. George B. Penrose, Hostess

Evening Entertainment Feature
Masquerade Ball (Tentative)

FRIDAY, DECEMBER 7th

Golf Tournament for Men
The Metaire Club
Thos. H. Taylor, Chairman, Golf Committee
Tea for the Ladies, 4:00 P. M. at the club

Guest cards to golf clubs for the week will be provided for both ladies and gentlemen through the courtesy of the golf committee.

COMMITTEES

Engineering Committee — Chairman, Major James M. Fourmy, State Highway Engineer, Louisiana.

Arrangements Committee—Chairman, Hon. John Klorer, Commissioner of Public Property, New Orleans.

Entertainment—Hon. T. Semmes Walmsley, Commissioner of Public Finance, New Orleans.

Golf—Mr. Thos H. Taylor, New Orleans.

Publicity—Mr. Harold Wright, Aide to Mayor of New Orleans.

Reception and Welfare—Hon. Wm. T. Hall, Commissioner of Public Utilities, New Orleans.

Transportation—Mr. Walter F. Jahncke, Jahncke Service, New Orleans.

Registration—Mr. Sam Fowlkes, Manager New Orleans Convention Bureau.

Official Contact—Hon. Paul B. Habans, Commissioner of Public Safety, New Orleans.

Ladies' Committee—Chairman, Mrs. George B. Penrose, New Orleans.
Reception—Mrs. E. L. Jahncke.
Vieux Carre—Mrs. H. C. Ehrenfels.
Bridge—Mrs. L. M. Law.
Transportation—Mrs. Paul F. Jahncke.

Race Track Party—Col. H. C. Ehrenfels for Standard Oil Co. of Louisiana.

Boat Trip—L. M. Law for New Orleans Refining Company.

How Tax Dollar Is Spent

The city of Rochester, N. Y., has imprinted on its tax bills the above interesting dial chart, showing the disposition made of each tax dollar collected. The total revenue expected from this year's assessments is expected to be $16,330,232, representing a tax rate of about $26 per thousand dollars of assessed valuation. It is sometimes said that charts like this are a help in tax collection, since the tax-payer is more willing to pay out his money when he can see where it is going. In this day of increasing municipal expenditures and consequently increasing taxes, anything that helps take the sting out of the tax bill is well worth trial.

Large Contract for Riveted Steel Pipe

The Witt-Humphrey Steel Co., with general offices and works at Greensburg, Pa., has been awarded a contract by the Bureau of Water of Philadelphia, Pa., for 7 miles of 8 ft. and 6 ft. diameter steel pipe. The Witt-Humphrey riveted steel pipe will be shipped from Greensburg in sections 38 ft. in length, each section weighing about 26,000 lb. This contract will require about 1,000 freight cars as the size of the pipe will only permit the loading of one pipe section to a car. The steel plates from which this pipe will be manufactured are 9/16 in. thick and the total plate tonnage required for this contract will be approximately 20,000,000 lb. In all probability the plates will be rolled in the Pittsburgh district. The pipe will be protected against corrosion by being dipped vertically in a bath of special refined asphaltum and inasmuch as the Witt-Humphrey Steel Company had installed in their new pipe works at Greensburg one of the largest electrically heated dipping tanks in the country, they were in a position to fulfill the specified requirements for the dipping of such large pipe. Shipments of this pipe will begin about Jan. 1, 1929. The above company is now building at their works in Greensburg a pipe line for the city of Detroit, also 8 ft. in diameter, which contract will be completed in December.

Municipal Airports. — According to annual report of the U. S. Secretary of Commerce, made public on Nov. 30, there are 352 municipal airports in this country, with an additional 890 under construction or proposed. Department of Commerce intermediate fields now number 256. Military and naval airports and marked auxiliary fields bring the total number of flying fields to 1,356.

Dial Chart on Rochester Tax Bills

Recent Developments in Municipal Construction and Operating Equipment

One of the Dry Chemical Feed Devices Used in Purifying the New York City Water Supply

Feeds Dry Chemicals with Accuracy

A photograph on this page shows the installation of a Power Feed AMF Automatic Weighing Machine at the Valhalla, N. Y., station of the New York Board of Water Supply, Gas and Electricity, where it is used to automatically weigh and discharge dry chemicals into the water undergoing treatment at that plant. This device, model 883B, is said to have an accuracy of 90 per cent balanced weights and 10 per cent within ½ of 1 per cent of balance.

This device is said to be fully automatic in action and may be quickly and easily adjusted to weigh any definite quantities of chemicals at predetermined intervals. Continuous action takes place within the scales while the hopper is kept supplied with chemicals.

These machines are manufactured by the Automatic Weighing Machine Division of the American Machine and Foundry Company, 5502-5524 Second Ave., Brooklyn, N. Y.

Climax Offers Direct Connected Pump

The Climax Engineering Company, of Clinton, Iowa, offer a drive for any type of water pump. The engine is mounted on cast iron rails which in turn is applied to a cast iron sub-base direct connected to the pump which is also mounted on the same base by flexible coupling cushioned in rubber.

The engine used is Climax Model KU, 4 cylinder, 5 in. x 6½ in. and is conservatively rated with ample reserve power to drive a 6 in. water pump with a capacity of 1,200 gal. per minute, against a 75 ft. head. A unit of this type is said to be ideal for semi-permanent or permanent installation, and being mounted on its own base it is easily portable.

New Fire Station Door by Truscon

A new type quick-acting door was installed recently by the fire department of Hempstead, L. I., in its fire station, and has attracted considerable interest from architects and fire chiefs who have seen the door in operation.

The door operates in two units of two doors each, and an electric motor providing the power. The entire opening is cleared in five seconds, and operation is noiseless and free from jar when the doors swing to the full open position, according to the manufacturers.

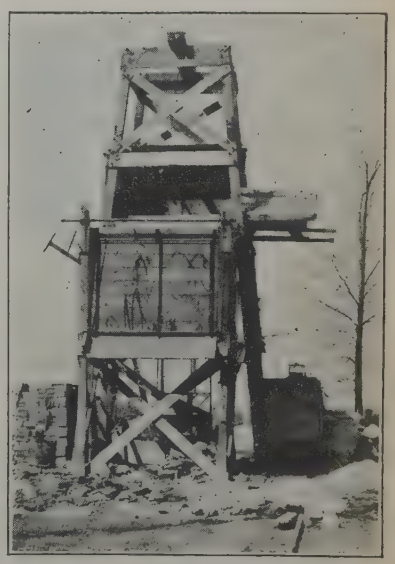
The operation is in response to a switch thrown by the man in charge of the station upon receipt of an alarm. The doors are open full before the driving motor on the fire engine can be started.

The Hempstead doors are painted cream with a black trim, and present a very pleasing appearance. They were manufactured and installed by the Truscon Steel Co. of Youngstown, Ohio.

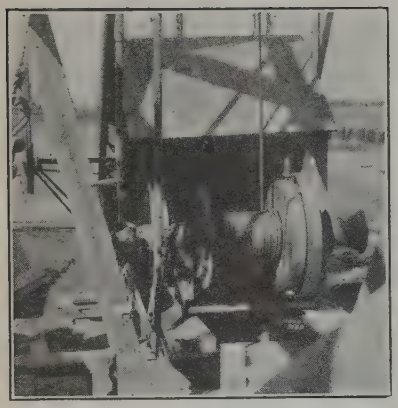
Use of Hoists at Tunnel Shafts

On sewer and aqueduct work in tunnel, disposition must be made of spoil. On level country it is usual to sink shafts and install some sort of hoisting apparatus in the shafts to raise the spoil to the surface for loading into trucks or other equipment in which the spoil is hauled to the dump. Typical examples of such work are the sewer jobs being done by Louwers and Somerville, Michigan Theatre Bldg., Detroit, Mich., in that city. These contractors are using three Novo single drum, electric powered hoists on their sewer tunnelling jobs in that city, at different shafts. The illustrations show how these hoists are arranged to handle both spoil and sewer lining materials.

A head frame was erected over the excavation, and at one side, halfway up, a bin was built. This bin held the excavated material; trucks being loaded by gravity from this hopper. Above the hopper was a track and small industrial car, serving the purpose of a platform for the spoil bucket to drop upon, which action emptied the spoil bucket. The car was rolled aside while the spoil bucket was being hoisted to the top of



Headworks Layout at Sewer Shaft to Hoist Spoil and Lower Materials to the Tunnel. The Spoil Is Loaded by Gravity Into Motor Trucks



Novo Hoist Operating at Sewer Tunnel Shaft

the head frame; the hoist operator controlling both the spoil bucket and car. The spoil bucket was 45 in. long. 24 in. wide, and 18 in. deep.

At one side of the shaft, a 10-S electric powered mortar mixer was placed, which dumped into a bucket lifted and lowered by the Novo NH hoist, powered with a 7½ H.P. electric motor. Brick was piled on the other side of the excavation, which was also lowered by the hoist down the shaft, which had a depth of about 40 ft. Approximately 200 brick constituted a load, which, as in the case of the spoil, weighed, including the bucket, 1,500 lb.

Such tunnel operations, while expensive, obviate open cuts and are particularly adaptable to certain ground conditions that are encountered in various parts of the country, and are often preferable where otherwise the cuts would be of excessive depth.

New Spark Control for Climax Engines

The Climax Engineering Co. of Clinton, Ia., has perfected and now offers for sale on its heavy duty industrial engines a new Automatic Spark Control.

This new spark control operates from the suction in the intake manifold. As the variation in pressure in the intake manifold is proportional to the load imposed upon the engine, the ignition is always timed correctly, no matter how the power varies on intermittent loads, and by timing the spark automatically, this new device does what operators could not possibly do by hand, according to the manufacturers.

There is little loss of power and the fuel consumption decreases to a point where a saving of 10 per cent on fuel is attained on intermittent loads, such as are encountered in earth moving machinery, locomotives and similar classes of equipment, it is claimed, and that it will reduce spark knocks and reduce wear on bearings.

The Automatic Spark Control can be quickly installed in the field on any model Climax engine. The small additional cost of installation is offset in a few months by the saving it affords in fuel consumption. It can be applied by Climax Service Stations.

This is one of the many new exclusive features that the Climax Engineering Co. is incorporating on its engines to meet the present day need for modern and up-to-date power equipment.

New Type Perfex Radiator for Diesels

A new type of radiator for Diesel and heavy duty engines has just been announced by the Perfex Corporation. The new feature is the mounting of an unusually large air circulating fan directly on the radiator frame. This is completely protected by a screen as shown and shrouded to insure uniform air circulation over the entire radiator. The fan is carried on anti-friction bearings and provided with a large enough belt pulley to insure positive fan operation over long periods without attention, it is said. On account of the large size of both radiator and fan it is usually very difficult to mount the fan on a Diesel engine and at the same time locate it where the radiator may be efficiently cooled.

These radiators also incorporate the latest developments in removable core sections. Each unit is securely held in place by four nuts. This permits removal and repair of any individual section without dismantling the radiator and also continued operation of the power plant for reasonably long periods while a section is out. An alternative is to carry a reserve section which can be put in the place of a damaged section in a few minutes.

The cores of these heavy duty radiators are made from copper to prevent corrosion. The tubes are oval in shape, have double lock seams that are said to make them burst-proof when frozen. Copper, heat radiating fins, strengthened by reammed front and rear edges, furnish a most efficient design of cooling unit. These are baked onto the tubes in ovens that have automatic temperature control in order to insure uniformity of product. To supply the industrial field, a full line of these radiators are now available for prompt delivery in sizes from 50 to 350 hp.

New Combination Conveyor and Screen

The photograph on this page shows the new Northern portable conveyor in operation with shaker screen attached.

This equipment has recently been patented by the Northern Conveyor & Mfg. Co., of Janesville, Wis. The combination of their style of shaker screen with many of their portable conveyors results in a complete loading and screening plant of the portable type on two wheels that may be moved from place to place on a moment's notice by hitching on behind a truck or wagon.

It carries its own power plant, requires no assembly when moved to a new location or no mechanical labor to make ready for moving. It is a complete, portable plant—without question the simplest on the market, according to the manufacturers. It does for a small gravel pit or a contractor everything that large, heavy and cumbersome conveyors and screening equipment with hoppers will do, yet at the same time there is no erection involved as the equipment comes to a customer completely set up in every respect, it is said.

Its cost is very small and the shaker screen or the conveyor may be used separately and quickly detached from one another for their respective uses.

New Combination of Portable Conveyor and Shaker Screen Announced by Northern Conveyor and Mfg. Co.

Speeder Announces Half-Yard Machine

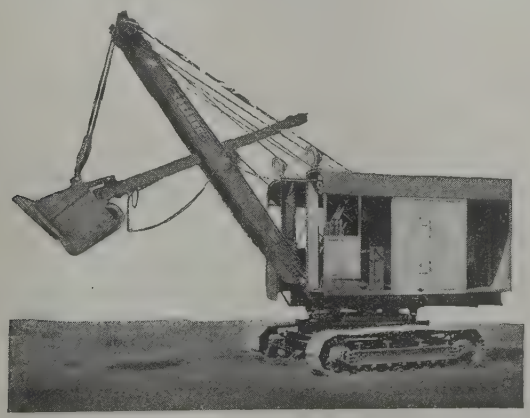
A new model, the B-2, has recently been introduced by the Speeder Machinery Corporation, Cedar Rapids, Iowa, manufacturers of Speeder fully convertible, full revolving gasoline and electric excavators.

The new model is of one-half yard capacity and incorporates many improvements over the Model B-1, which no longer is in production.

The sliding gear used in the Model B-1 in making the change from traction to swing has been made obsolete by the introduction of a reversible jawed clutch assembly. The new jawed clutch assembly retains all the desirable features of the sliding gear formerly used and has the added advantages of positive mesh of the gears at all times, and of making all vertical shafts removable and readily demountable, insuring unequalled ease in operation as well as long life.

Electric lights and starter are standard equipment on the new model. There are two flood lights on the top of the cab for night work or travel by night, a dome light in the top of the cab which illuminates the upper mechanism, and a spot light that is used for a trouble light. The starter button is situated on the floor boards. The operator can shut off his motor while waiting for trucks and start immediately by stepping on the starter button. The operator operates all the controls, gas and spark levers, light switch and starter button while seated in his seat near the front of the cab.

A Hercules Model OX engine is used in place of the Model O used in the Model B-1, thus giving added power. Other improvements on the new model Speeder are double tread sprockets that are much heavier in weight and a large turntable that is likewise greatly increased in weight.



This New Model Speeder Machine Has Interesting Features

Pump Manufacturer Announces New Line

The Frederick Iron & Steel Co., Frederick, Md., who have been manufacturing centrifugal pumps for a time, have now added a line of hand and power operated diaphragm pumps. These new pumps have been especially designed for handling water containing mud, sand, gravel, sewage, grit, and other material, and should prove quite useful on such jobs for which this type of pump is used, such as in trenches, cellars, sewers, manholes, and so on.

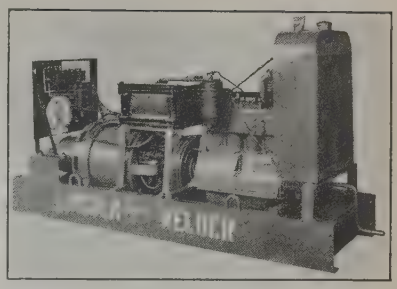
The pumps are said to be of extra heavy construction and simple in design, with the diaphragm of highest quality rubber. The pump has rubber faced suction and discharge valves, properly weighted, with the suction regularly threaded for iron pipe. Bottom and side suction types are supplied in 2½ in., 3 in., and 4 in. sizes, with respective capacities of 1800, or 3500, and of 6000 gal. per hour. Portable outfits arranged for either engine or electric drive will be furnished to order. Detailed information and prices will be supplied by the manufacturer upon request.

New Gas Engine Driven Welder

To meet the growing demand in construction work of all kinds, The Lincoln Electric Co. of Cleveland O., announce a new model of the "Stable-Arc" welder, known as their S-1960 Model.

The ever increasing importance of arc welding in structural work, pipe line construction, and similar work, has indicated the need of a self contained, light weight, readily portable arc welder with its own motive power.

The new unit has a rating of 200 amperes according to N. E. M. A. standards, with a current range for welding duty of from 50 to 300 amperes, and operates at a speed of 1,500 r.p.m. Motive power is provided by a four cylinder Continental Red Seal engine, type H-9.



New Gasoline Engine Driven Welder Announced by Lincoln Electric Co.

The welding generator and engine are mounted on a structural base welded into a solid piece of steel. This welded steel base is said to provide a maximum stiffness and rigidity with a minimum weight; the whole unit weighing only 1,580 lb. and being only 76 in. long by 25 in. wide.

The generator is also constructed of steel instead of cast iron, usually used. Thus, not only reducing weight but also reducing the possibility of breakage in the field.

The complete magnetic circuit of the generator is of laminated steel structure, thus increasing the stability of the arc which is highly desirable in work for which this unit was brought out, because many times welding must be done in a vertical plane and frequently overhead.

A steel switchboard is also provided in place of the usual slate or composition board, thus still further reducing the possibility of damage in the field.

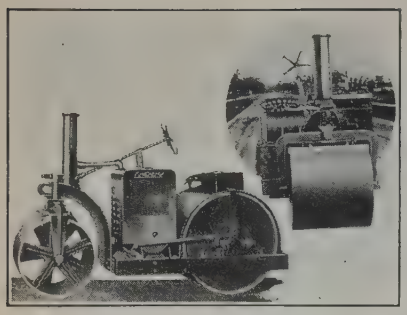
It is stated by the company that this unit is not designed to replace their present heavy duty engine driven equipment but to meet the need for a light but sturdy unit.

New Roller for Small Contractor

The Pierce Governor Company, of Anderson, Ind., has announced a new light roller that should prove of value on light small jobs were a 1½ to 2 ton roller is sufficient for the purpose. This new roller is especially adaptable, it is said, to such operations as rolling crushed stone, filling station drives, concrete floors under construction, subdivision work, and asphalt between street car tracks, as well as for rolling park lawns, golf courses, tennis courts, and for similar work. It is small enough for use in close places where a large roller could not be handled.

The operator sits above the rear roller in the middle of the machine, with a clear view in all directions and controls the roller as easily as he would an automobile. Frame clearances are such as to permit rolling up to a curb or within four inches of a wall.

The rear roller is hollow and may be filled with water, sand or iron borings to make the desired weight. This drum



New Pierce Roller Designed for Small Jobs

holds approximately 1,000 lb. of water.

The entire frame is of steel. The motor runs at any speed from idling to 1,800 R.P.M. under governor control. Speed is instantly adjustable from driver's seat.

The motor is a Continental Red Seal, and is a solid unit with clutch and transmission, and this motor is completely housed, while clutch and transmission are enclosed. The transmission has one speed forward and one reverse. Shafts are mounted on New Departure ball bearings. The best of materials are used in all parts and a sixty-day guarantee is made to cover defects that might be discovered. Alemite lubrication is provided throughout.

The manufacturers say that production of one roller a day will soon be reached.

New Tractor-Welder Combination

A new mounting of the standard Lincoln electric stable arc welders has been announced by the sales department of the Pontiac Tractor Co., Pontiac, Mich. The welder unit with stabilizer and panel are mounted on a frame, which attaches to either the McCormick-Deering 10/20 or Fordson tractors.

This mounting of the Pontiac Lincoln Arc Welder gives a 4-wheel rubber tired self-propelled unit, capable of hauling heavy loads behind itself. This unit is also mounted on crawlers for soft ground work.

Power is taken from the tractor, to drive the welder, through the power take-off pulley, which has a clutch, allowing it to be thrown out or into gear at will. The ahead drive of the belt brings the belt tightener into the correct relation with the belt.

New Combination of Welder and Tractor for Pipe Line Work

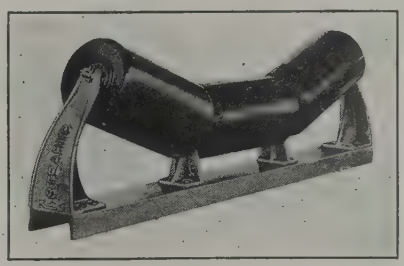
The manufacturer states that a number of these units have been put out as special equipment over a period of four years and have proven successful on pipe line construction and structural steel fabricating, showing considerable saving over former methods of welding.

New Carrier for Belt Conveyors

A new Rex-Stearns belt conveyor carrier has been announced recently by the Stearns Conveyor Co. of Cleveland, O., for mounting their pressed steel and chilled rim cast iron idler units.

Several noteworthy features are included in the design. The supporting brackets are made of certified malleable iron, and by the redistribution of the metal, a much stronger bracket has been worked out than is possible in grey iron with no considerable increase in the total amount of metal used.

The spacing between idlers is reduced to $\frac{5}{16}$ in. on this new Rex-Stearns carrier. With this close spacing, there is



New Belt Conveyor Carrier Recently Brought Out by Stearns Conveyor Co.

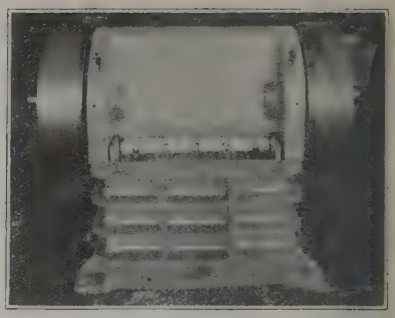
very little chance of the belt "creasing" and being worn accordingly. With this new type of bracket, it has been possible to secure this close spacing and at the same time keep the idlers safely mounted and quickly and completely interchangeable. Any idler can be removed from the carrier without disturbing any of the others.

The carrier is offered in the following sizes: 18 in., 20 in., 24 in., 30 in. and 36 in., with either Rex-Stearns pressed steel or chilled rim cast iron idlers, both having one-piece pulley shell construction, Timken bearings, long time lubrication, and the Stearns positive grease seal which serves the double purpose of keeping dust out of the idler and grease within it.

The new idler is interchangeable with previous Stearns units. The Stearns Conveyor Co. is owned by the Chain Belt Co. in Milwaukee, Wis., who manufacture chain conveying equipment.

A New Roller Bearing Wheeling Jaw Crusher

The Wheeling Mold & Foundry Co. of Wheeling, W. Va., who have been manufacturing jaw crushers for over 15 years, announce that they are now marketing a roller bearing jaw crusher, after months of experimental work and



New Roller Bearing Jaw Crusher

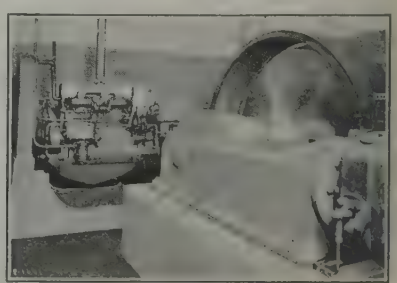
shop tests. Both pitman and main frame bearings are equipped with roller bearings, needing no adjustment.

Factory tests on hard granite and slag through a 9 x 36 crusher, weighing 10,270 lb., with hopper fully loaded, are stated to indicate less than 10 HP. actual ammeter readings. It also is stated that it was possible to turn the crusher freely by hand, and several large granite boulders were thrown in and actually crushed by turning the flywheel by hand. The roller bearing types are claimed to be practically free from vibration. The frame is a solid one piece cast steel structure as in the past. All jaws are manganese steel. Shaft is nickel alloy steel. Bearing construction is fool proof and dust proof. All parts are interchangeable. Regular equipment includes cast steel guard, wrenches and oil gun. The company manufacture the new crusher in four standard stock sizes, together with its regular line of bronze bearing crushers.

Air Compressor Driven by High-Speed Diesel Engine

An interesting application of Diesel power is shown by the accompanying illustration. It consists of a two-stage 16 in. x 10 in. x 14 in. air compressor of the horizontal type driven by a four-cylinder Buda-M.A.N. Diesel engine of 6 in. bore and 8 in. stroke operating at 950 r. p. m. A Twin Disc clutch is enclosed in a housing bolted directly to the flywheel enclosure, and the engine is connected to the compressor by means of a short belt and idler pulley.

The compressor delivers 400 cu. ft. of air per minute against a pressure of



Two-Stage 16 in. x 10 in. x 14 in. Air Compressor Driven by Buda-M. A. N. Four-Cylinder 92-Hp. Diesel Engine Operating at 950 R. P. M.

130 lb. per sq. in., and the air is used to operate Harris air-lift pumps in a deep well, raising the water from a depth of approximately 167 ft. and delivering it to a storage tank.

The engine is the full Diesel type, with a normal operating speed of 1,000 r.p.m. and rated at 93 hp. at that speed. The actual brake-horse-power load varies from 80 to 87 hp.

Fuel with a gravity of 28 to 30 deg. Baume is used, and is supplied from the storage tanks through a Niagara meter to a tank mounted on the engine-room wall. From the latter the fuel is fed to the injection pump on the engine by gravity, and a Zenith duplex filter is installed in the line to remove any foreign matter that may be in the fuel. Fuel is injected by the mechanical or solid-injection system, which is under control of the built-in governor. The time of injection can be advanced or retarded manually, and the quantity of fuel regulated, so that the speed of the engine can be controlled manually as well as by the governor. The fuel is conducted from the injection pump through steel tubes to dividers mounted on the cylinder jacket, from which the fuel is delivered to spray nozzles on opposite sides of the combustion chamber of each cylinder. The two nozzles are diametrically opposite, and the fuel is sprayed into each chamber parallel to the top of the piston. The nozzles are so arranged that the "sprays" pass to each side of the radial center line of the combustion chamber, so that the fuel spray cones do not meet, thereby causing turbulence of the oil particles. Consequently, combustion is complete and efficient, as evidenced by the fact that fuel consumption ranges from 0.40 to 0.45 lb. per brake horsepower, and that smoke is absent from the exhaust under widely varying loads and speeds.

Lubrication is accomplished by means of a positive gear-driven pump of large capacity, a pressure of 45 lb. per square inch being maintained to all bearings, piston pins, and to the valve gear on each cylinder head. All moving parts are enclosed to promote cleanliness and lubricating oil economy, and a filter cleans all oil before it passes back into the engine. A lubricating oil reservoir fitted with gauge glass, settling tank and screen is mounted on the flywheel housing. The dry sump system is used to insure uniform lubrication under all conditions.

A small air-cooled, two-cylinder, opposed-type, gasoline engine, shown at the right in the accompanying illustration, is mounted on the flywheel housing and is used for starting duty. This engine is connected by a conventional type Bendix gear through a manually operated clutch and a short roller-chain drive. The Diesel starts with the same kind of fuel used for regular operation, and no compressor or preheating devices are required.

This engine was installed several months ago for the purpose of observation and test, and is operated by the regular power-house attendants. The only attention required is limited to a brief visit of the engineer several times a day, it is said, and the replenishing of fuel and lubricating oil at stated intervals.

The Buda-M. A. N. Diesel engine is built under license and patents of the M. A. N. Company of Augsburg, Germany, with whom Dr. Rudolph C. Diesel was associated until his death. It was in the M. A. N. shops that Dr. Diesel built his first engine about 35 years ago. The Buda-M. A. N. is built by the Buda Company, Harvey, Ill.

A Plaster Mixer with a Hoist

Installation of a hoist on their plaster mixer, "The Mechanical Hoeman," has been announced by Marsh-Capron Company, Chicago, Ill.

The hoist is mounted on the counter shaft of the mixer, and can be operated while mixing or independently. It is provided with an automatic brake which holds the load when the clutch is disengaged. The large winch head projects in the front of the machine, making it easily adapted for the operation of elevators or other hoisting work. The hoist is also provided with a safety ratchet and with automatic lubrication by compression grease cups. The standard engine equipment has been found to give ample power for a large amount of hoisting work.

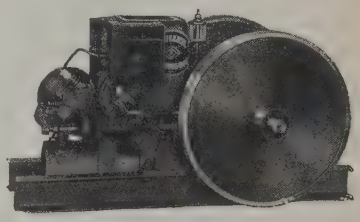
Another improvement recently announced on this plaster mixer is a new stuffing box on the hoe shaft. A semi-metallic packing is used in an outside stuffing box mounted in a cast head in the drum head casting. The packing can be changed at any time without dismantling any other part of the machine and the packing glands can be tightened while the shaft is revolving. An open space between the stuffing box gland and the bearing prevents plaster from working into the bearing housing, thus assuring long bearing life. The machine is provided in two styles of mounting—a four-wheel rubber-tired trailer, with telescoping steel hauling hitch where a high degree of portability is desirable, or on truck with four steel wheels.

The "Mechanical Hoeman" is provided with a mixing hoe formed of steel bars especially shaped to give rapid, thorough mixing and complete scraping of the barrel at every revolution. Discharge is effected by rotating the drum, the discharge spout being part of the drum itself and so shaped as to confine the batch to a narrow stream, permitting discharge directly into wheelbarrows.

The completely enclosed 2 cylinder hopper-cooled LeRoi or Novo engine is continued as standard equipment, with electric motor drive optional. This equipment turns the hoe shaft at a speed of 24 R. P. M.

Fuller & Johnson Announce Improved Engines

Interesting improvements have been recently made in three of the engines manufactured by the Fuller & Johnson Mfg. Co., Madison, Wisconsin. These three improved industrial engines are known as Model "NC," in 1½, 2 and 2½ h.p. One of the recent improvements to be found on this model is the solid disc flywheels and the gib key shroub, making for better appearance and greater safety and which make for smoother running. These models are designed to be mounted on steel channel skids of 3, 4 or 5-in. channels, which may be mounted with the angles facing in or out and which are available in any length. Thus installation problems



This Shows the General Appearance of the New Line of Industrial Motors Recently Produced by the Fuller and Johnson Mfg. Co.

are easily met. The cylindrical fuel tank, located between the skids, is attached directy to the cylinder casting, to which it is attached by a cradle of 2-in. adjustable steel strap. The tank is strengthened with a rolled bead at the point of contact with the strap.

The gasoline filler pipe is amply large enough to permit filling without the use of a funnel, and is carried out at an angle so as to make it easy to insert a measuring rod. This pipe is fitted with a threaded cover to avoid spilling the fuel in case of a portable installation. The tank is air vented to permit rapid filling.

The throttle is easily accessible to the operator, while the water drain has been placed on the operating side of the engine. The vaporizer opening is from the bottom of the elbow, making a presentable appearance.

These engines are equipped with a simple governor that adjusts the frequency of power impulses in accordance with the load, thus making for efficient operation. The cooling system is comprised of good sized water hoppers and water passages entirely surrounding the cylinders to their full length.

These motors are well built for long life, low maintenance, and economical operation, according to the manufacturers.

Chicago Board of Education Has Director of Safety.—A full-time director of safety has been appointed by the Chicago Board of Education. His duties are to promote safety education, traffic reform, increased playground facilities, and to arouse public interest in the work.

New Trade Publications

The following industrial literature of interest to the City Engineer, the City Manager, the Superintendent of Streets, the Water Works Superintendent, and to the engineer or other man otherwise interested in municipal construction, design, or operation problems, has been received. Copies may be secured by writing direct to the manufacturer named.

Compressed Air Tools.—Ingersoll-Rand Company, 11 Broadway, New York City, manufacturers of pneumatic tools, compressors, and related equipment, have issued a new condensed catalog, Form 1604-A, that illustrates and briefly describes such Ingersoll-Rand products as portable compressors, rock drills, paving breakers, hoists, clay diggers, pneumatic tools, hose, steels, and other equipment that is widely used. Copies of this catalog can be secured upon request.

Pumps.—Beach-Russ Company, 50 Church St., New York City, have issued a new bulletin, No. 37, describing their rotary pumps, designed for a number of different kinds of service. Complete condensed data on these pumps will be found in this bulletin.

Power Shovels.—The Koehring Company, Milwaukee, Wis., has sent out a folder telling how the Koehring independent crowd means full dipper loads on any job. This is one of a series of folders prepared by this concern telling about their power shovels and other equipment.

Gasoline Engines.—Climax Engineering Company, Clinton, Ia., has sent out a bulletin, under date of April 21, telling what the new spark control on Climax engines means to the user.

Electrical Equipment.—General Electric Company, Schenectady, N. Y., has issued a number of new bulletins describing various electric control apparatus, such as controllers, D. C. motors, centrifugal air compressors, arc suppressor plates, automatic throw-over panels, enclosed starting rheostats, magnetic controllers, etc. Ask for bulletins GEA-894, 948, 950, 934, 308-A, 233-B, 752 and 835-A.

Curing Agent.—Barber Asphalt Company, Philadelphia, Pa., has issued a booklet telling about Curcrete, their new asphaltic emulsion that is sprayed onto the surface of a new concrete pavement to provide a good condition for curing the concrete.

Celite.—Celite Products Company, 1320 S. Hope St., Los Angeles, Cal., has issued a specification sheet on the use of Celite as an admixture in concrete. Special directions are given for use under a water-cement ratio specification.

Floodlighting.—General Electric Company, Schenectady, N. Y., has issued a new and comprehensive bulletin, GEA-161B, on equipment for floodlighting, and for general searchlight and airport lighting. This bulletin shows a variety of equipment available for these purposes.

Super Cement.—Lawrence Portland Cement Company, New York City, have published an interesting catalog describing their Dragon Super Cement, a cement that is particularly manufactured for obtaining concrete that is waterproof, and resistant to the action of salts and oil. This cement is standard portland, to which have been added a gypsum material Catacoll, and Tannin in a certain proportion, taking the place of some of the usual gypsum retarder. The Catacoll itself is said to promote the hydration of the silicates and aluminates in the cement. The booklet gives information about this cement that is worth reading.

Cement Gun Construction.—The Gunite Concrete and Construction Company, 1301 Woodswether Road, Kansas City, Mo., have just issued an attractive bulletin entitled "Cement Gun Shots—Bulletin No. 7," which contains 32 pages 8½x11, and 95 illustrations, all pertaining to various classes of Cement Gun construction performed by this company in their thirteen years exclusive experience in this type of construction, and this bulletin will be forwarded to anyone upon request without obligation on their part and should particularly interest all Consulting Engineers and Architects.

Portland Cement.—International Cement Corporation, 342 Madison Ave., New York City, has recently published an interesting booklet entitled "Trade Ethics and Marketing Policies," containing an outline of the business policies of the concern. The first page of this 38 page booklet states 31 points of trade ethics observed by the company, the second part is an explanation of the factors and conditions which control the price policy of the company, and the last part of the booklet presents a statement on the reasons for the sales policy observed. This concern and its subsidiaries manufacture and market Lone Star cement.

Form Clamps.—Beton Forms Engineering Corp., 75 Tenth St., Long Island City, New York, has issued a bulletin describing the Beton Column Form Clamp. This is a metal clamp using four wedges for setting, and is said to be very strong and to cost less than other clamps.

Industrial Notes

The Naylor Spiral Pipe Company announces that, with the completion of their new plant and the increase of their facilities some 200 per cent the name of the company has been changed to the Naylor Pipe Company. The new product of this organization, Spiralwell Toncan Iron Pipe, no longer being comparable to light weight, sheet metal pipe, but putting it rather in the category of standard weight pipe, has necessitated the increased facilities, as well as the change in company name. There will be no change in management, all officers and executives carrying on in their present positions.

The T. L. Smith Company of Milwaukee, builders of Smith Mixers and Pavers, announce the appointment of Woodward-Wight Company of New Orleans as their distributors for Louisiana and southern Mississippi. The new distributors have long been identified with the supply and equipment business in this territory and are particularly well equipped to handle this new account. A full stock of mixers and parts are being carried to insure immediate sales and repair service.

The Chain Belt Company has elected Robert W. Baird, Milwaukee banker, a director to fill the vacancy caused by the death of H. O. Seymour. Mr. Baird is Vice President of the First Wisconsin National Bank, President of the First Wisconsin Co., and Vice President of the First Wisconsin Trust Co. Directors re-elected to the board of the Chain Belt Co. are Donald Fraser, William C. Frye, J. C. Merwin, C. R. Messinger, Clifford F. Messinger and Edgar L. Wood. The Chain Belt Company was organized in 1891 and operates three plants in Milwaukee, West Milwaukee and Cleveland. The Cleveland plant operates under the name of the Stearns Conveyor Co., having been acquired 18 months ago. During the last year the Chain Belt Co. purchased the plaster and mortar mixer business of the Atlas Engineering Co., and also acquired the pump and saw rig business of the C. I. Longenecker Co., both local concerns. The Contractors Equipment Co., at Miami, Fla., is also owned by the Chain Belt Co. The products manufactured include concrete mixers and pavers, conveying equipment, chain for power transmission and other material handling machinery. Milwaukee concerns closely affiliated with the Chain Belt Co. are the Interstate Drop Forge Co., Federal Malleable Co., and the Sivyer Steel Casting Company.

The Celite Company of Los Angeles announces that effective April 30, 1928, they have purchased the plant and property of the National Magnesia Manufacturing Company at Redwood City, about 25 miles south of San Francisco. The business of the latter company will be continued under the name of the National Magnesia Company. Both The Celite Company and the National Magnesia Manufacturing Company started in business in 1912 and since that time have built up businesses of national and international scope. The manufacturing plant of The Celite Company is located at White Hills, (near Lompoc) California. This is the largest plant in the world engaged in the manufacturing of diatomaceous earth products (including heat insulating materials, filter-aids, admixtures for concrete and many grades of mineral fillers.) The business at Redwood City includes the manufacture of magnesia, asbestos and diatomaceous earth insulating materials. This business will be continued and the scope of its service enlarged under the new name, National Magnesia Company.

The Mathieson Alkali Works, Inc., 250 Park Ave., New York City, manufacturers of heavy chemicals, announces the appointment of E. E. Routh as Manager of Sales, following the resignation of John W. Boyer, who had occupied that position for the past six years. Mr. Routh has been a member of the Mathieson organization for 30 years, with the exception of four years in college, having started in as office boy at the Saltville Plant at the age of 11. For the past 8 years he has held the important post of Southern Sales Manager, with headquarters at Charlotte, N. C. Effective at once, he will now be transferred to the executive offices of the company in New York City. The company also announces the appointment of Fred O. Tilson, who has been representing the company in the Southwest, as Southern District Sales Manager, with offices at Charlotte.

The Ames Pump Company, 90 West Street, New York, a division of the Staten Island Ship Building Company, has appointed Yeomans Brothers Company, 1423 Dayton Street, Chicago, to handle their line of vacuum heating pumps in Chicago and vicinity. Yeomans Brothers Company are manufacturers of sewage ejectors and pumping machinery.

H. P. Sigwalt, who for the past five years has been advertising manager of the Milwaukee Corrugating, has entered the advertising agency field with the Cramer-Krasselt Co., Milwaukee, where he will take charge of the Industrial Advertising Division. As former Secretary and at present 3d Vice-President of the National Industrial Advertisers Assn., Vice-President of the Milwaukee Advertising Club, and formerly President of the Milwaukee Association of Industrial Advertisers, Mr. Sigwalt is widely known in the advertising profession. His broad and varied experience in the advertising department of Geuder, Paeschke & Frey Co., Milwaukee, and as Advertising Manager of Federal Motor Truck Co., Detroit, Mich.; American Optical Co., Southbridge, Mass.; T. L. Smith Co., (concrete mixers), Milwaukee, and Milwaukee Corrugating Co., Milwaukee (Milcor Sheet Metal Products), has helped him develop an advertising-merchandising perspective which should prove valuable in the advertising agency field. Mr. D. C. Smith has been appointed to succeed Mr. Siwalt as Advertising Manager of Milwaukee Corrugating Company.

Mr. H. L. McCauley has been appointed District Sales Manager of the Inland Steel Company's Milwaukee Office succeeding Mr. C. M. Easterly, who recently resigned. Mr. McCauley has been assistant district sales manager of this office since 1924. From 1920 to 1924 he was in the Order Department of the Inland Steel Company at Chicago. Prior to that time he was associated with the American Sheet & Tin Plate Company at Gary, Ind., Pittsburgh, Pa., and Saltsburg, Pa. Mr. M. E. Gregg will succeed Mr. McCauley as assistant district sales manager in Milwaukee. Mr. Gregg has been assistant district sales manager of Inland's St. Paul offices since 1925. His previous business associations were with the Bethlehem Steel Company, Lackawanna Steel Company, Republic Iron & Steel Company and the Basset-Presley Company.

The Webster Manufacturing Co., manufacturers of elevating, conveying and power transmitting machinery whose office in Cincinnati is in charge of Mr. L. A. Scheck, are moving their headquarters from 1914 Union Central Bldg., to 503 Chamber of Commerce Building. Mr. Scheck is an experienced engineer in the elevating and conveying line, and has been in the employ of the Webster Manufacturing Co. for a number of years. Before taking charge of the Cincinnati office he was in charge of the Boston office of the Webster Mfg. Co.

J. H. Williams & Co., Buffalo, and the Husky Wrench Company, Milwaukee, announce the completion of a reciprocal sales arrangement which enables them to supply the trade with a unique line of Combination Wrench Sets. Each set is composed of Williams' "Superrenches" and "Husky" Socket Wrenches in popular sizes and furnishes the most complete and efficient wrench service obtainable, it is claimed. These sets are said to offer the first and only combination of high grade Chrome Alloy Steel Open-End and Socket Wrenches in standard assortments. Every "Superrench" and "Husky" Socket is guaranteed against breakage. This arrangement enables each company to merchandise in Combination Sets the other's quality Open-End or Socket Wrenches. It is made for sales purposes only and is limited to the items which constitute the sets.

The American Hoist & Derrick Co., of St. Paul, has just appointed J. T. Seaver, Inc., Fairmount Cedar Building, Cleveland, Ohio, its representative for the Cleveland district.

The T. L. Smith Company of Milwaukee, builders of Smith Mixers and Pavers, announce the appointment of the Service Supply Corporation of Philadelphia as their distributors for eastern Pennsylvania, southern New Jersey and northern Delaware. This organization has been prominently known in this field for some time and resident salesmen throughout their territory give them particularly close contact with the construction industry. A complete stock of mixers and repairs for both mixers and pavers place this organization in a position to render immediate sales and repair service.

Mr. F. A. Ernst has been appointed Assistant District Sales Manager of the Inland Steel Company's St. Louis office effective immediately. Mr. Ernst succeeds W. F. Brumm, who was advanced to the District Sales Managership of this Inland Office last August. Mr. Ernst's business career started in 1914 with the Trumbull Steel Company. He has been associated with the sales departments of several steel companies since that time—most recently he was in the Chicago office of the American Rolling Mill Company.

The National Aluminate Corporation, a Delaware Corporation, with general offices at 6216 West 66th Place, Chicago, announces that it has purchased the stock, names, patents, trade marks and good will of the Chicago Chemical Company and the Aluminate Sales Corporation, both of Chicago. The new officers are Arthur Meeker, Chairman of the Board; H. A. Kern, President; P. W. Evans, Vice President, and H. J. Young, Secretary-Treasurer. Dr. G. J. Fink will remain at the head of the research department.

Snow Removal Equipment Useful for Clearing Streets in Any Community

Equipment That Will Be Supplied by Manufacturers for the Coming Season

THE WINTER of 1928-29 will soon be upon us. In 36 states of the Union and throughout the Dominion of Canada, municipal officials will be called upon by the business men and the home owners to keep the streets clear of snow throughout the heaviest snowfalls, or at least to clear the way after the storm has ceased, in order that buyers may reach the merchants' stores, that employees can reach their employment, that the children may attend school without inconvenience, in order that supplies can continue to be delivered without hindrance, and in order that the police and fire departments may well continue to afford protection throughout the city. The direct financial loss occasioned by unremoved snow is enormous. In New York City, one storm alone cost the merchants approximately $60,000,000 a day. In Chicago, a single storm in 1918 caused a loss in trade of $20,000,000 to downtown stores. The losses in a smaller community, while smaller, are proportionally as great, and every bit as serious to each merchant involved. Two inches of unremoved snow on the streets of a city will be found sufficient to seriously impede traffic and bring about business losses. The surface lines in New York City, in one winter, lost one million dollars in fares due to the inability of riders to get to work. Too, a municipality with a recognizable rural trade will find it to its interest to insist upon keeping the roads open that lead to the community, in order to keep this desirable trade that would otherwise cease altogether during the period of blockade, or be diverted to a more far-sighted community that could be more easily reached. The rural task will fall to county and state, but should be insisted upon by the community that would reap the benefit.

While the cost varies widely with the amount of snow to be removed, the snow removal equipment used, and the methods and management brought into play, it will be found that the cost is an investment well worth while, an investment that will be repaid ten-fold in maintenance of business and the flow of the normal life of the city.

While costs and methods and management will be largely discussed elsewhere in Municipal News and Water Works, the information in the following pages will afford municipal authority a good picture of the types of equipment that will be found available this season for snow removal work, and will indicate the ways in which the various machines have been used to good advantage.

A Baker Plow Mounted on a Commerce Motor Truck on City Work

Baker Snow Plows.—The large line of Baker Snow Moving Equipment manufactured by The Baker Mfg. Co. of Springfield, Illinois, includes both "V" and blade types. Snow plows are made for attachment to leading tractors and standard motor trucks. Among the many models, are the well-known Patent Trip Blade Snow Plows for motor trucks which permit use on pavements likely to contain obstructions such as man-hole covers, car tracks, etc. When the blade strikes the obstruction it swings back and, upon passing, trips back instantly thus not injuring truck or plow. These blades are in sections of about two feet wide. Other models include snow plows for McCormick-Deering and Fordson tractors up to those for Five-Ton, thirty, Ten-Ton and sixty. The heavier plows are hydraulically operated. Special speed plows both "V" and blade type have been developed for use with motor trucks employed at great speeds. In every Baker Snow Plow there is evidence of a desire on the part of the manufacturers to make snow plows of unusual strength, a snug fit on the truck or tractor and the maximum of convenience in its operation.

North Hydraulic Digger.—The North Hydraulic Digger, manufactured by the W. M. Blair Mfg. Co., 3673 Michigan Ave., Chicago, Ill., is designed to lift piled snow from the street, in loads of one cubic yard, and elevate and dump this snow into a motor truck or dump

A North Hydraulic Digger Loading a Motor Truck on Municipal Snow Removal Work

wagon. The lift is 90 in. This machine is said to be capable of loading from 300 to 500 cu. yd. of snow per day. In the summer the same outfit is used for digging and handling other material.

The power unit of this machine is the Fordson tractor, and the digger can therefore be operated by anyone who can operate the Fordson. Only one man is needed in its operation. The tractor is equipped with rubber tired wheels for this service, for operation on city streets. The lifting action is accomplished by means of a hydraulic hoist at the front of the tractor.

Barber-Greene Snow Loaders.—Cities should think of Snow Loaders as insurance against loss from snow. Fire engines do not pay for themselves by daily work, but rather by being on hand when needed. It is the same with snow loaders; they frequently pay for themselves in one storm.

Comparative figures show that a snow loading machine will do the work of 50 to 200 shovelers, that it will work tirelessly day and night, that it costs very much less, and that it is remarkably faster. It is good business to use snow loaders.

There is no longer any need to put up with the delays caused by snow, because it can be removed quickly by modern machinery. Barber-Greene Snow Loaders manufactured by the Barber-Greene Co., Aurora, Ill., have been used successfully for eight seasons in the largest cities in the country, and in many smaller ones.

Mechanical loading methods other than with a Barber-Greene have been tried, but none of them, it is claimed, have been able to approach the 10-hour record made in Albany, when a Barber-Greene loaded more than 2,000 cubic yards into trucks or the average of 1,600 cubic yards maintained by the Boston Elevated Loaders, and similar performance by all other Barber-Greenes.

In two of the cities where other loading machines were said to have been successful, Barber-Greenes have since replaced them.

Three machines are necessary for the quick removal of snow; they are: The snow plow, the snow loader, and the motor truck.

A snow plow quickly clears a path to permit some traffic and at the same time piles snow into windrows for the snow loader. The snow loader picks up the snow and loads it into trucks which haul it away. This procedure is practical, simple, and fast.

It utilizes the trucks to their maximum capacity and can be continued almost indefinitely. The maximum continuous run was maintained in Boston, when a Barber-Greene Snow Loader loaded trucks for 112 consecutive hours.

The storm which called out the Barber-Greene machine in Manchester for the first time was one of the worst blizzards experienced for more than

Two Views of Barber-Greene Snow Loader at Work in a Snow-Clogged Municipal Street

two years in a country where the average snowfall is more than 60 in. in a winter. In 48 hours 21 in. of snow fell. A fierce wind caused drifting and tied up the train and trolley service throughout the country.

With a big tractor snow plow to windrow the snow into the gutters and a Barber-Greene to load the snow into trucks, the City of Manchester soon emerged from its snow cover.

Trucks were driven along with the traffic until they reached the snow loader which worked in the opposite direction. Loaded trucks moved without disturbing traffic.

Other snow handling equipment machines owned by this enterprising city are: One Holt 10-Ton Tractor equipped with a Sargent tractor-plow; four Champion Blade Plows which are attached to 5-ton trucks such as White, Mack, Packard, and Federal; one Sargent Truck Plow.

Madison, Wisconsin, having an average annual snowfall of 35 in. and a population of 40,000 is too big to allow blocked streets. Business in Madison suffers from a snow blockade in relatively the same degree as the largest city in the country. In Madison the city officials considered the city too large to allow snow to get the better of them. They now have a Barber-Greene Snow Loader.

And on the other hand, the city is small enough so that the snow problem can be almost completely solved by the application of one Barber-Grene. A city which uses 50 to 200 shovelers to remove snow can solve its snow removal problem almost completely by the purchase of one machine. In this way, a medium sized city can solve its snow removal problem more easily than a larger city which must purchase several machines to replace thousands of shovelers.

Fox Snow Loader.—Here is a loader that will dig and load snow into motor trucks in a single operation. It is said to load at the rate of 100 yds. per minute, and travel at the rate of ½ to 15 miles per hour. This loader, which discharges into a truck at either side or rear, is made of steel throughout, and equipped with Hyatt roller bearings. The esculator can be raised or lowered automatically in 10 seconds, say the manufacturers. If trucks are not available, the snow can be cast to the side of the pavement. In Chicago, one of these loaders could load a truck in 35 to 55 seconds, and kept 10 trucks busy. In Cleveland, the machine loaded 420 trucks in an 8-hour shift after one storm, with each load about 6½ cu. yds., according to the manufacturers. This loader is manufactured by the Fox Rotary Snow Broom Co., 2 La Fayette St., New York City.

Mattson Snow Fence.—While primarily used in rural districts, snow fence has its applications inside the corporate limits of a municipality as well. On the outskirts of any community, and in many parks, there are locations devoid of structural improvements where the winter winds cause the unusual formation of heavy drifts on streets and sidewalks. These drifts greatly increase, at times, the work of the snow removal forces. The careful use of snow fences at these locations, in regions of heavy snowfall, will often cause the formation of the drifts on vacant lots or at points in the park where they will do no harm, diverting these drifts from the roadways. The fencing is readily removed to storage in the spring, and easily erected in the fall. One successful type of snow fence is that manufactured by the Mattson Wire and Manufacturing Company, Joliet, Ill. This fence is made of heavy hardwood pickets woven between the best grade galvanized Bessemer steel wire, according to the manufacturers. The wire is tightly twisted to prevent slippage of the pickets, and pickets have their tops perfectly even. This type rolls up in convenient lengths and is easily installed in the late fall and removed in early spring.

Link-Belt Snow Loader.—The photograph on this page shows a Link-Belt "Grizzly" loading snow into 5-ton trucks on the Parkway in Philadelphia, at the rate of a truck in a little more than a minute.

The machine, designed and built by Link-Belt Company, Philadelphia, turns completely around in practically its own length—a feature of real advantage on a thoroughfare such as the one on which it was working. Heavy crawler treads, together with a reserve of power, enable it to walk into the snow; its construction is such that the snow is gathered and brought to the buckets almost without the assistance of hand labor, according to some claims that have been made by the manufac-

turer. There were but three men working with the machine—one operator and two to clean up.

The use of this loader is determined only by the season, as in warmer months, or during one of those seasons known colloquially as "an open winter," this same machine will be found handling sand, stone, gravel or coal.

Haiss Snow Loader.—The Haiss Snow Loader shown in the photograph is one owned by the City of New Bedford, Mass., shown at work during their snow removal campaign. It is used to load piled snow into motor trucks.

Haiss Snow Loaders, manufactured by Geo. Haiss Mfg. Co., New York City, are said to have a loading capacity of 10 to 15 cu. yd. per minute. They are equipped with feeding and cutting propellers which cut a swath 8 ft. wide and as the Loader is equipped with a slow speed worm drive that pushes it into the pile at a speed of 9 ft. per minute, this combination will dig not only snow but frozen snow as well as ice, claim the manufacturers.

It is equipped with a 41 HP. Waukesha engine having a Ricardo head, is creeper mounted and will travel anywhere. It is equipped with the Haiss manganese feeding propellers and clean-up scraper to do away with the pick and shovel.

The mounting is the Haiss Creeper chassis and the Snow Boom is of the flight type of steel plate trough 33 in. wide equipped with flights 11 in. high, 24 in. apart, carried by manganese elevator chain. The crowding speed is 9 ft. per minute which can be used for heavy digging or 65 ft. reverse speed for light digging. The elevator boom is adjusted by the Haiss worm and jack knife raising device which means the operator can raise the boom quickly if necessary. The flights are ¼ in. steel plate, bent to give a cutting action on the tail shaft, and are equipped with teeth.

Joy Snow Loader.—The Joy Manufacturing Company, of Franklin, Pa., holding basic patents on a mechanical gathering device, has developed a loading machine for decreasing the cost of snow removal from city streets. The working head of this machine is an exact duplicate of the well-known Joy device, which is used by the coal industry.

The Joy Snow Loader has capacities for any character of snow and will load from 10 to 20 cu. yd. per minute. The design and construction of this unit is based upon the extensive manufacturing and field experience gained by the solution of widely varying mechanical loading problems.

Operated by one man, at high gathering and delivering speeds, over any kind of paving, the Joy Snow Loader is designed for rapid clearing of streets and roadways, and for loading fresh or frozen windrows of piled ice and snow into trucks. The machine consists of two main units.

A steel chassis mounted on solid rubber tired wheels, carrying a Hercules Model "G" four cylinder gasoline power unit, operative at 6 speeds forward and 2 speeds reverse, with forward speeds ranging from 74 ft. per minute to 12 miles per hour.

A steel conveyor frame mounted on the chassis at adjustable angles for operation, and for low clearance when traveling, carrying the Joy patented gathering mechanism, consisting of two rotating arms which sweep the material

Link-Belt "Grizzly" Loader Handling Snow in Philadelphia

Haiss Snow Loader at Work in New Bedford, Mass.

The Joy Snow Loader, Recently Introduced

into the conveyor delivering to trucks through a swing chute.

Gettelman Hi-Speed Snow Plow.—The Gettelman Hi-Speed Snow Plow manufactured by the Heil Co., Milwaukee, is an example of modern snow removal equipment. Modern snow removal programs place high speed snow plows on the pavement soon after a snow storm begins and, if the fall is heavy, the plows stay on the job twenty-four hours per day until the storm subsides and the highways are cleared. Not only is this method less costly, but the thoroughfares are actually open all of the time, full width, instead of being blocked for days following a storm. State Highway Departments find that tax revenues from increased gas consumption, made possible by open highways, actually pays for the removal of snow under this plan.

Any truck of two tons' capacity or larger can handle a Gettelman Snow Plow at 20 miles per hour or faster. Dry snow has been handled by two-ton trucks traveling at 35 miles per hour, and wet snow at a slower speed, depending on the depth of the snow, say the manufacturers. Snow that weighs 45 lb. per cubic foot is considered as wet snow.

Traveling in wet or dry snow at the speeds mentioned, the snow will run up the curved blade in a sheet and spread itself evenly across the roadside and into the field much like a sheet of water spread by a speed motor boat or hydroplane. The snow from one storm spread in this manner does not pile up a windbreak that would cause the snow from a second storm to immediately drift into the roadway.

One county, with nine Gettelman plows attached to their regular road-building and maintenance trucks, following this program keeps more than 250 miles of main traveled highways open at all times. For side roads and emergency service several tractor units are maintained, but these nine plows cost less than one heavy duty V-shaped plow and tractor.

The Gettelman Hi-Speed Snow plow is made in 9-ft. lengths for 1½ to 2½ ton trucks and in 10-ft. lengths for 3-ton truck and larger. All blades are 38 in. high. For light duty trucks short push arms place the center of the blade 46 in. from the center of the front axle. Longer push arms for heavy duty trucks make this distance 56 in.

Steel plate 3/16 in. thick is used in the blade. The cutting edge is made of high carbon steel and this plate is reversible, thereby doubling its life. Structural steel angles reinforce the curvature of the blade and the cutting edge. The push arms are telescopic, seamless steel tubes affording maximum strength at minimum weight. A universal front axle attachment secures

Blade Type Gettelman Plow Mounted on Front of Motor Truck

the pusher arms to any make and model of truck. The hoist frame, winch, and cab control rod are light but sturdy in construction, and the plow is easily raised to carrying position because the worm and gear are machine cut. Tension type springs are easily adjusted to plowing conditions. All castings are electric steel, thoroughly annealed and machined to jigs, assuring standardization of parts.

The installation of the plow on any truck requires only a few hours and is said to be a very simple job. Once the installation is made, it requires only a few minutes to detach the plow or attach it again, according to the manufacturers.

There are but three possible positions for the blade, and these have been predetermined by scientific tests. The telescopic push arms permit quick adjustment of the blade to throw the snow to either side of the road, or the blade may be adjusted squarely across the front of the truck for bull-dozing snow at street intersections or other wide areas.

One of the features of the plow is the tripping action of the blade which protects it against damage from any obstructions it might hit. The blade is pivoted to the push arms so it can tilt forward, and the tension springs and the counter-balancing effect of the snow brings the blade back to the scraping position immediately. The deeper the snow the more it helps to return the blade to the operating position because the pivoting point is below the depth of the snow against the blade.

Another feature is the offset of the blade in respect to the truck. The discharge edge extends a foot beyond the truck wheels. This offset minimizes the side draft because the pressure of the snow on the offset portion of the blade throws the pressure line to the rear of the steering knuckle of the front wheel. This tends to make the truck nose toward the discharging snow instead of away from it. Then, too, the truck can stay on the pavement and still clear the snow beyond the edges of the concrete. With chain drive trucks it is possible to plow close to the curve and yet keep the snow from getting into the chains and causing extensive wear of the jack shaft bearing. The correctly predetermined angle of the blade also minimizes a side draft.

For municipal work the plow can be operated to pile the snow along the curb for removal.

Pneumatic Snow Plow Lift.—The Good Roads Machinery Company of Kennett Square, Pa., for years the pioneers and leaders in the snow plow industry, in collaboration with the White Motor Truck Company and the Westinghouse Air Brake Company, has developed and placed on the market a pneumatic lift for snow plows attached to trucks and busses that is unique and novel. It is believed to be the first application of compressed air for the function of raising and lowering a snow plow suspended from the front of a motor vehicle, it is said. Prior to this development a second operator has been necessary on the driver's seat for the sole purpose of operating the manual

General View of Champion Model 10-C Blade Type Plow on White Truck, Equipped With Pneumatic Lift Outfit

lift device of a snow plow. This entailed considerable added expense for comparatively intermittent and unskilled service, but absolutely necessary as it was out of the question to add this to the duties of the driver. This particularly applied to busses and made the problem here especially difficult, because, at best, no space was available for the plow operator. The simplicity and economy of the Good Roads-Westinghouse Pneumatic Lift insures its quick adoption by bus companies, truck operators, highway departments, transit companies, and others. The driver can subconsciously operate the snow plow by means of an air valve and a latch rope, without distracting his attention nor adding to his physical efforts.

The lift is operated by a vertical Westinghouse air cylinder attached to the "A" frame clamped to the chassis in front of the radiator. It is easily substituted for the prevalent hand hoist on existing plows. The lift chain is automatically locked when the air is shut off, but can be quickly released by pulling the trip rope. Trucks and busses equipped with air brakes require no further attachments than the air cylinder and lock. Those not equipped with air brakes can, with a modest expenditure, attach a compact Westinghouse Air Compressor to the timing gear box on the motor and the necessary air tank to the chassis. Tests show the time required to raise a plow with this device is counted in seconds instead of minutes formerly consumed by hand operation, the manufacturers claim.

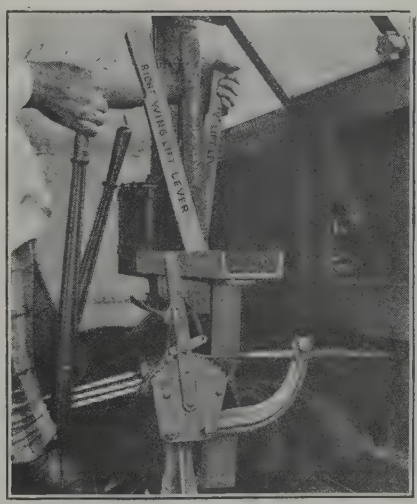
It is common practice to leave the "A" frame on the front of the truck or bus during the snow season, as only a few minutes are then required for hooking on the plow when needed. However, the "A" frame is also readily removed when desired. This Good Roads-Westinghouse unit is suitable for any type of snow plow,—one-way, V, shovel nose, etc.

The entire combination is covered by patents and patent applications.

LaPlante-Choate Plows.—The greatest improvement which has been added to the snow plows manufactured by the LaPlante-Choate Manufacturing Co., of Cedar Rapids, Iowa, in recent years is an improvement added this year, namely, the putting of the hydrawlic controls in the cab of the tractor where the entire plow may be operated entirely by the tractor-driver. This feature eliminates two or three men ordinarily required to operate a snow plow, and it also enables the tractor driver to speed up his work considerably, the manufacturers claim.

The Control of the Pneumatic Lift Device

With hand-operated plows it is necessary to stop the tractor in order to make adjustments on the wings or "V". The wings on a snow plow have the same effect on the operation of same that the oars have on a boat, as far as side-draft is concerned. If you drag one oar, the boat turns in that direction, and the same is true with the wing on a snow plow. Consequently, since plows are generally operated in varying depth of snows, it is essential that the wings be raised and lowered frequently, to permit the tractor to maintain its forward motion without interruption. The tractor driver himself,



View of Controls on LaPlant-Choate Snow Plows

is the only person who knows when the forward progress of the tractor is being impeded by a wing dragging, and consequently, he should be in a position to raise or lower the wing which is causing his trouble, and to do it instantly.

With these new hydraulic controls in the cab of the tractor, he can raise and lower the wings instantly, without stopping the tractor. He can also assist the operation of the plow materially in other respects.

The mounting used on LaPlante-Choate plows, is such that the entire weight of the plow can be placed on the tractor for transportation or when needed to increase the traction. For instance if the tractor operator feels that the tracks are slipping in the soft snow and ice, all he needs to do, is to throw the lever which raises the plow and raise the plow up about an inch, and thus throw the entire weight of the plow on the tractor This weight will add traction to the tracks of the tractor, and in most cases prevent their slipping.

Front View of LaPlant-Choate "V" Type Snow Plow

Trackson-Sargent Plow.—A snow plow unit which is attracting attention this season among those who are familiar with snow removal methods consists of the McCormick-Deering 10-20 Industrial Tractor, with Model DH Trackson Full-Crawlers, and the Sargent Snow Plow which is especially adapted to mounting on this crawler tractor. This is manufactured by the Trackson Company, Milwaukee, Wisc.

Neither of the machines which compose this unit is new in itself, but the combination is a recent development of interest. Highway officials, contractors, engineers, etc., are already familiar with the McCormick-Deering Industrial Tractor, the Trackson, and the Sargent plow.

The ample power provided by the McCormick-Deering takes the plow through deep, hard-packed snow or loose, fresh drifts, with the Trackson Full-Crawlers giving the unit positive traction, light ground pressure, and sure footing, say the manufacturers.

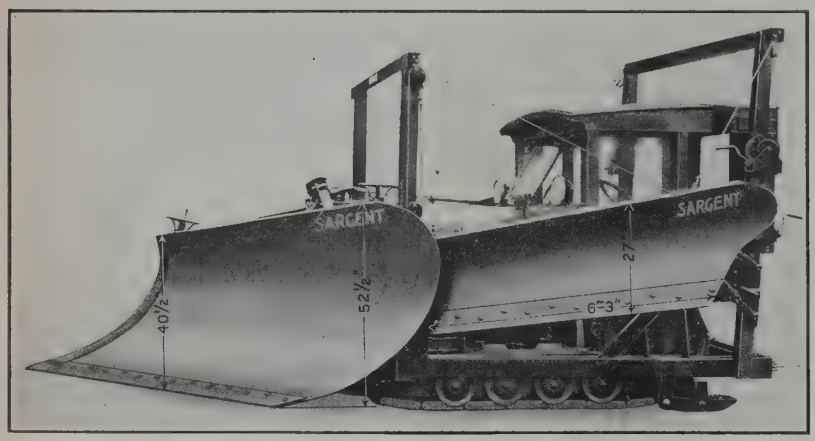
This model of the Sargent may be used either as a wing or as a V-plow. For an average fall of snow the wings may be spread to their full width of 17 feet, and for very deep, packed drifts they may be raised entirely and brought in close to the tractor, so that only the V-blade is left to plow the first channel. Or, when it is necessary to push back only one bank, either wing may be lowered and spread while the other is kept in the raised position, so that all of the power of the tractor is directed to the lowered wing.

Another feature of this plow is the fact that the V-blade may be let down so that it plows the snow right to the ground, or it may be raised an inch or two so that it will leave enough snow on the roads for sleighing.

One of the most important advantages of the Trackson McCormick-Deering snow plow unit is the fact that at the end of the winter season the Sargent Plow can be removed quickly and easily, and there will remain a 3½-ton crawler tractor ready for road construction or maintenance jobs, land clearing, dirt moving, and the countless other jobs which public works involve.

This year-around usefulness is a big factor in the economy of any snow removal equipment, for most communities cannot afford to use a machine for only a few months and have it remain idle in storage for the rest of the year.

Crane Loads Truck.—Cranes such as the Universal are often used for loading piled snow into trucks. The Universal has been used in several cities such as Detroit, Chicago, Syracuse, Utica, Rome, N. Y., New York City, etc. In New York City, as many as thirty motor truck mounted Universal Cranes have been used during the heavy snow months of latter January and February.



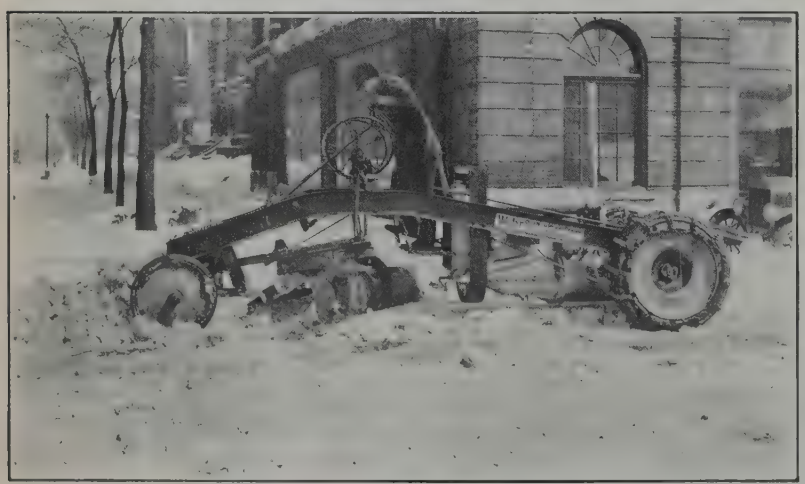
The Sargent Snow Plow Mounted on the Trackson-McCormick-Deering Unit

Universal Crane Handling Snow on Broadway, in New York City

The photograph shows such a unit operating on Broadway in New York City.

Various data collected on the ability of these machines to handle snow, according to the manufacturers, shows that they can easily load an average of 9 to 10 cubic yards into trucks in 2½ to 3 minutes. In the city of Syracuse, the commissioners of Public Works, stated that the city machine saved $2.00 a truck load on loading the snow. The usual procedure in using the crane unit is to clear the streets of the snow piling it into the big windrows at the side of the streets which are then loaded by the crane unit. One and a half cubic yard snow buckets are used on the crane, and the trucks can be equipped with high side boards so that they can haul nine to ten yards at a trip. One of the main advantages of the unit is that after the snow freezes and the piles get rather hard the clamshell action of the snow bucket is able to bite through without very much difficulty and handle the frozen snow and ice. Occasionally the units have been equipped with ¾ yd. digging buckets and teeth to handle some of the exceptionally hard packs of icy snow.

Another feature of the unit is the motor truck mobility so that they can become busy on various other jobs when they are not required for snow removal work, and can be easily transported into congested districts when the storm suddenly comes up. The Borough of Queens, New York, has recently purchased four Universal Cranes, all motor truck mounted, to be equipped with 1½ yd. snow buckets in reserve for snow removal work in New York and vicinity this winter. These units, like other Universal Cranes, are adaptable to 101 other uses throughout the balance of the year. This crane is manufactured by the Universal Crane Company, Lorain, Ohio.



Wehr Grader at Work Clearing a City Street

Wehr Graders.—These graders, manufactured by the Wehr Company, Milwaukee, Wis., are used with a scarifier to remove ice, and with the grader blade to windrow the snow and any ice that can be moved by this means. These are one-man power graders built around a light tractor, and are useful for patrol purposes in the summer. A typical instance of ice removal has been reported from Queen Victoria Park, Ontario, Canada, next to Niagara Falls. At this location the spray from the falls collects on the main driveway, and in the winter as much as 6 to 18 in. of ice will form on the drive in the course of one night. This drive is 36 ft. wide and the section subjected to this

ice formation is 1,500 ft. long. The ice is first broken up with the Wehr grader equipped with a nine tooth scarifier, this operation taking about one hour with 12 in. of ice. The blade was next used, and the ice removed in about two hours. This method saved about two days time over pick and shovel methods, and the saving in cost was reported to be about $150,000, and the road was kept open. On ordinary snow removal, this grader is said to keep from 18 to 20 miles of road open throughout the season at a cost of less than $8.50 a day.

Walter Snow Fighter.—A photograph on this page shows the Walter Snow Fighter with the patrol plow and the center scraper pressure blade and equipped with a low level type of dump body, as extensively used by cities and municipalities.

The Walter Snow Fighter manufactured by the Walter Motor Truck Company, Inc., Long Island City, N. Y., has been especially designed and constructed for snow displacement service. There is a positive drive to all four wheels under all traction conditions. This is obtained by means of patented automatic lock differentials. The motor is of the heavy duty six-cylinder type and developing over 100 H. P. This, together with the special 10 to 1 range transmission, makes possible maximum speed for all snow conditions.

The front plow has been designed to pour and throw the deep snow off the road and out of the way. The center pressure scraper blade can scrape right down to the road surface removing all packed snow and ice. This center pressure scraper blade is provided with suitable cushion springs to prevent damage.

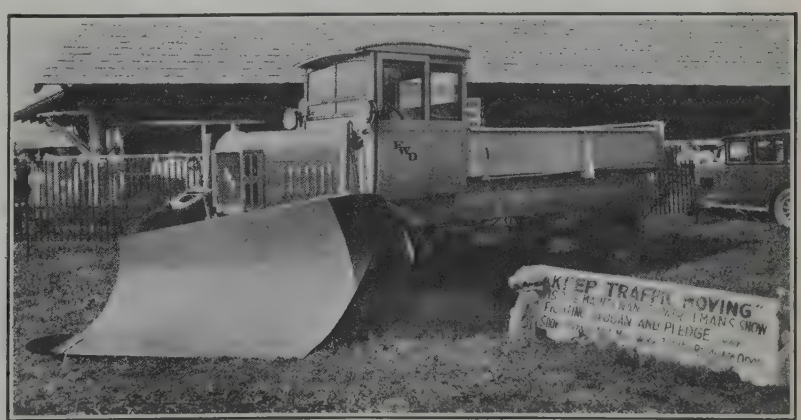
These units are equipped with dump bodies either of the sand and gravel type or special garbage type or with flusher tanks and road oiling equipment so as to make them servicable the entire year.

Bucyrus-Erie Shovels.—Some municipalities have made use of a steam shovel or gas shovel for picking up snow piled along the curbs and loading this snow into trucks to be hauled away to the dump. This is said to be a good method. A photograph in this issue shows a Type B Bucyrus-Erie shovel doing this work in the city of Boston. The shovel is standard. It is often the practice when using shovels for snow removal work to replace the standard dipper with a special one of about 4 cu. yd. capacity that has been developed for the purpose since snow is a relatively light material except when it has been converted to ice by a thaw followed by a sudden freeze before the removal work can be completed. Thus, in an emergency, a shovel can always be rented and relied upon to do good service. This particular shovel is so well known as to need no description at this time. It is manufactured by the Bucyrus-Erie Company, Erie, Pa.

FWD With "V" Plow.—At the Missouri State Fair this year, the Missouri State Highway Department exhibited as one of their types of snow removal equipment a FWD truck equipped with the "V" type plow shown on this page. This is a high speed plow that throws the snow to the side of the pavement for future attention, and is equally applicable to municipal work, where the snow is first piled along the curb by such plows and then loaded into trucks for disposal. The FWD truck is manufactured at Clintonville, Wisc.

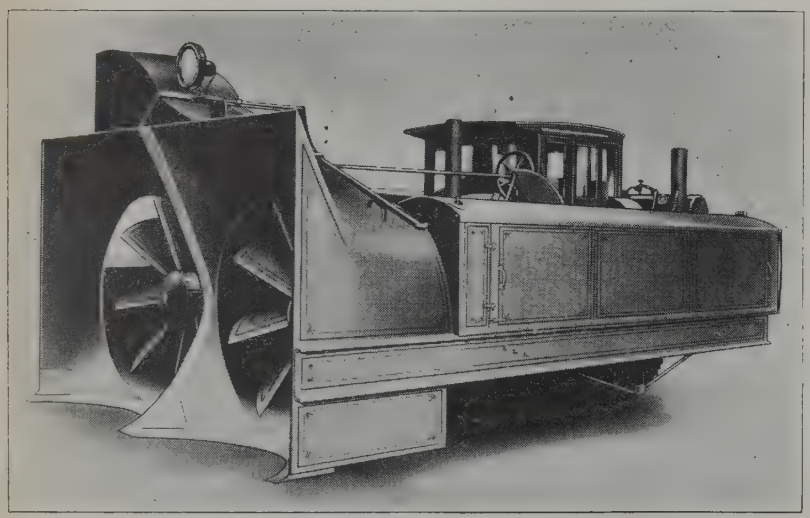
The Walter Snow Fighter, a Truck Type Plow

A Type B Bucyrus-Erie Shovel at Work Clearing Snow from a Street in Boston, Mass., and Loading It Into Motor Trucks



FWD Truck Equipped with "V" Type Plow for Municipal and Rural Snow Removal Work, or the Type Used by the Missouri State Highway Department

Cletrac Equipped With Snow King Rotary Plow



The Edwards Rotary Snow Plow

The Edwards Rotary Snow Plow at Work on a Heavy Drift

Cletrac With Rotary Plow.—A photograph on this page shows the Cletrac Model "100" equipped with a Snow King Rotary Plow and used last winter by the State Highway Department of Michigan. This is a very efficient outfit, particularly where the snow is heavy and deep drifts have formed. The Cleveland Tractor Company, Cleveland, O., also builds a complete line of Cletrac Crawler Tractors, consisting of four models, all of which are equally adaptable for winter use. Various snow plows have been adapted for each of these models so that the manufacturers are in a position to furnish the power requirement in almost any instance where a tractor can be used for keeping roads and city streets open during the winter season.

Edwards Rotary Snow Plow.—While primarily intended for rural snow removal work, the rotary snow plow will find occasional application in the municipal field. One rotary that has been reported is that manufactured by the C. D. Edwards Manufacturing Co., Inc., of Albert Lea, Minn. This rotary clears a strip 13 ft. wide in one trip and throws the snow clear of the pavement. The plow is built with two individual motors which furnish power for revolving the rotors. Both motors are equipped with electric starters and automatic governors, allowing the operator to give his full attention to the driving of the plow. The motive power supplied is the 10-ton Caterpillar tractor. While the plow will handle all normal obstructions, a shear pin has been provided in each rotor to prevent damage should fence posts, logs and other major obstructions be encountered. Because of the design, side-draft is said to be eliminated, and because the plow is mounted at the center of each track of the tractor, putting no weight on the tractor frame, there is no tendency to ride over the work. Depth of cut, it is said, can easily be controlled from the cab. The weight, including the tractor, is 38,000 lb., he length overall is 30 ft., the height overall is 12 ft., and exclusive of the tractor, the plow delivers 200 h.p. Equipment is standard automotive equipment, and ample fuel capacity is supplied.

New Adams Snow Plow.—J. D. Adams & Company of Indianapolis, Ind., have just announced a new snow plow for use on their motor graders—the No. 10 with McCormick-Deering Tractor and the No. 11 with "Caterpillar" 20 Tractor. This plow designed with the cooperation of the LaPlante-Choate Company, leading snow plow manufacturers, is of the same type successfully used on truck throughout the country by state and county highway departments. When lowered the plow rides on three caster wheels with a road clearance of about 1 in. The plow is very readily raised by the hand control in the operator's cab. Wings are optional, but are recommended.

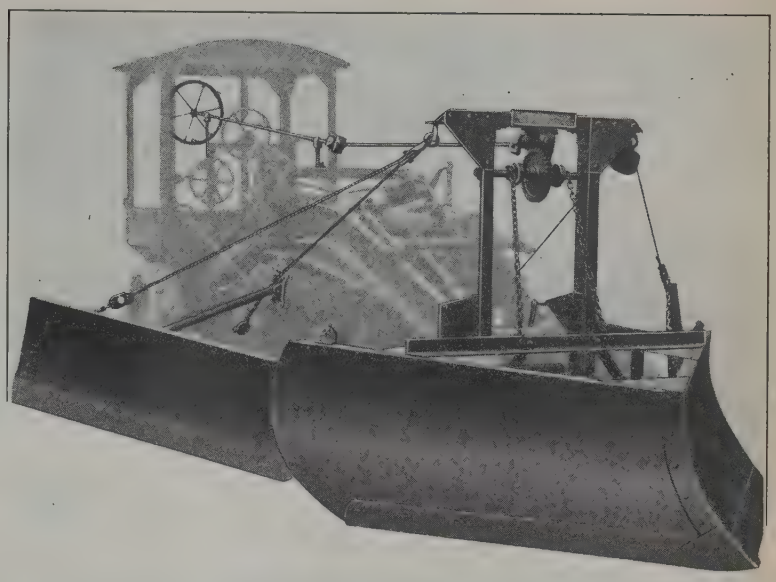
They are fully adjustable vertically and in and out to meet the various requirements encountered in snow removal.

The plow is said to be very strongly built throughout and well braced. The plow proper cuts to a width of 8½ ft. With wings the cut can be increased to 16 ft. The plow is 29 in. high in front and 33 in. at the rear. At any time during the winter it is desired to remove the snow plow from the grader temporarily it may be disconnected in a very short time, the upright lifting frame being left on the grader as it in no way interferes with the normal action or adjustment of the machine.

Caterpillar Tractors and Snow Plows.—As might have been noticed in the foregoing pages, a wide variety of snow removal equipment has been designed for use with the Caterpillar tractor, manufactured by the Caterpillar Tractor Co., San Leandro, California. The Caterpillar has been noted for stamina and power and general reliability, and it is these things that are of particular importance in any motive power for snow removal work, a service that is one of the most severe. Caterpillars have been found working with blade plows, "V" type plows, rotaries, and with scarifiers and other equipment for ice-breaking, both on municipal and rural work. Special small sidewalk plows have been developed for use with a light tractor for clearing sidewalks. Pratcically all plows are adjustable to leave a sleighing surface when desired.

Sometimes a drag is used, made of fitted timbers connected behind the plow, and clearing a 30-ft. strip. A cab mounted on the tractor provides sleeping accommodations in order that the plow can be kept working continuously night and day, with one operator sleeping in the cab while the other is at work. Other devices seen include the ice-breaking scarifier, cleated rollers for ice, elevating loaders of the bucket and belt types, grab buckets, skimmer scoops, special tractor loaders with snow buckets, power shovels, explosives, and pneumatic tools. A combination plow and loader has been developed, used in about the same manner as an elevating grader. Another new development is the adoption of one-man maintainers, powered with the 2-ton Caterpillar, for snow removal work. Special types of grousers and tracks are available to meet any special conditions that the Caterpillar may be called upon to encounter in snow removal work.

As to the cost of using tractor equipment, it is reported that Bangor, Me., in using the Caterpillar, has experienced costs of about $9.52 per mile, not including depreciation, insurance, or garage rent. This city was reported to have announced that it cost one-half as much to open 15 miles of pavement with horses as to maintain 102 miles with motorized equipment. The cost of motorized equipment all told was found



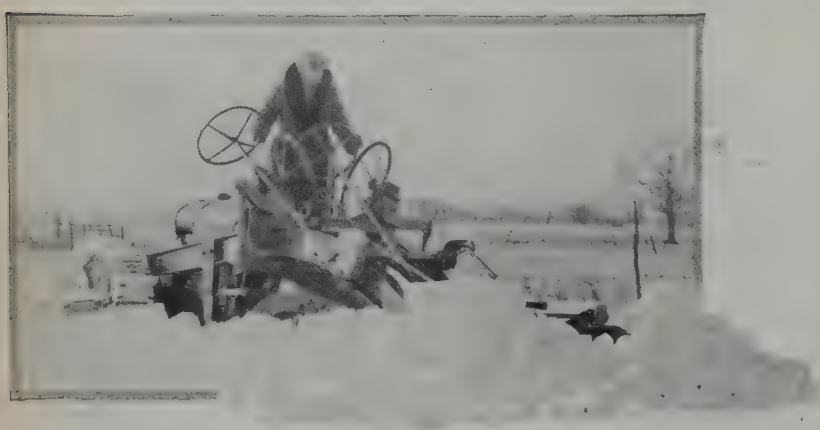
New Adams-LaPlant-Choate Snow Plow

Caterpillar 2-T with Snow Loader at Work in Montreal, Canada

Caterpillar 2-T with Russel Motor Patrol No. 4 Used in Lincoln Park, Chicago, Ill., to Keep Main Drive Open

Caterpillar 2-T with Killefer Snow Plow Operating in Portland, Ore.

Caterpillar 30 and Scarifier Used in Minneapolis, Minn.



The Warco Snow Plow Working with the Warco Grader

snow removal with horse-drawn equipment was said to have cost about $56.59 per mile. The City of Toronto, Canada, has been reported as experiencing a snow removal cost of from $26 to $72.50 per mile, using regular maintenance equipment as far as possible.

The Warco Snow Plow. — Designed for use with the Warco line of one man graders, the Warco snow plow is said to approximate $14.69 per mile, while to have proven to be a very efficient means of clearing streets and highways of snow.

Removing the scarifier from the grader, the plow is readily mounted in place of the scarifier. If the grader is not equipped with a scarifier the plow can be attached with no trouble by an unskilled mechanic in a short time, say the manufacturers.

The ordinary fall of snow can be cleared away quickly utilizing the plow only, it is said, but a heavy snow fall will require the use of the grader blade in addition to the plow. In employing both cutting edges the plow is raised and the blade lowered. When raised the plow clears the ground by 11 inches; this brings the highest point of the plow 41 inches above the ground line.

The Warco snow plow is said to be substantially built, and on account of its cheapness, low maintenance cost and one man operation, is claimed to be an economical means of keeping traffic moving during the winter months. The plow will increase the earning power of a grader, since the grader can be used during practically the entire year. The plows are manufactured by the W. A. Riddell Company, Bucyrus, Ohio.

Financing Sewage Disposal

Two bills of importance to Wisconsin cities will be submitted to the state legislature. The bills, which are sponsored by the League of Wisconsin Municipalities, are:

A measure permitting municipalities to create a fund for better sewage disposal by making a charge for sewage disposal.

A measure permitting municipalities to provide for a rival public utility to one already existing, if they consider the construction of such a utility preferable to securing the existing utility under condemnation proceedings, now permitted by law.

Proper Accounting Urged for City Utilities.—The report of the Municipal Securities Committee of the Investment Bankers' Association, of which John J. English of the William R. Compton Co. is chairman, published in the current bulletin of the association, strongly urges the use of proper accounting methods in determining earnings and value of municipally owned public utility properties. This applies primarily to such properties as are financed by the issuance of securities payable solely from the revenue derived from such systems.

How St. Louis Handles Minor Traffic Violations.—The city of St. Louis, Mo., has established a traffic violation bureau which aims to facilitate the handling of minor cases without the necessity of court action upon please of guilty.

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

To Our Readers

Distributor News is now one month old having appeared once in each of our monthly publications. But, this is a short time in which to become acquainted with 73,000 readers, the number to whom The Gillette Construction Group of magazines goes. Of course, not all of this large number are directly interested in the distributor section, but we hope all of our readers will look it over, for there is bound to be an item from time to time of interest to every one. It is a business asset to know with whom you are competing and Distributor News is the place to become personally acquainted with your friends and competitors.

Up-to-date our distributor friends from the far west seem to be a little ahead of other sections in number of stories telling of their organizations and growth. Distributor News congratulates the Pacific Coast on the business enterprise described in the stories coming our way. We should like to hear from other sections of the country with stories to match those of the west. Send in pictures of your warehouses and little sketches of your sales managers, with photographs if you care to present them.

Take advantage of this department, which is at your service. Create in it such a lively reader interest that it, too, will become a warehouse—not for equipment—but for information of interest to every equipment manufacturer and distributor. Send in your items of personal news, stories of your business growth, questions you would like to have answered or letters which you believe would be of interest to others in your field. Address all communications to Editor, Distributor News, Gillette Publishing Company, 221 East 20th St., Chicago.

Jenison Machinery Co. "A Division—Not a Separation"

The above title is the phrase which was used by Smith Booth Usher Company in announcing that the Jenison Machinery Company of San Francisco had acquired the stocks of machinery and equipment, together with the good will, of the Northern California Division of the Smith Booth Usher Company. In making the announcement, Mr. H. P. Usher, president of the Smith Booth Usher Company said: "Mr. Jenisen and his associates will continue the business along established lines, fulfilling our phrasing of 'A Division—not a separation.'" The new company is headed by E. S. Jenison, formerly vice-president of the Smith Booth Usher Company and manager of the San Francisco branch. Mr. Jenison became vice-president and San Francisco manager of this company in 1925, and to him and his associates Mr. Usher gives credit for the greatest advancement in the history of the business.

Soon after the formation of the Jenison Machinery Company, Mr. Jenison issued a statement of the merging of the Stuart S. Smith Company with the Jenison Machinery Company, and announced the appointment of Mr. Stuart S. Smith as manager of the Construction Equipment Division and a vice-president and director of the new company. Mr. Smith graduated from Leland Stanford University in 1907 and since that time has been identified with the construction equipment business in San Francisco. In 1919 he organized the Stuart S. Smith Company.

The Jenison Machinery Company will continue to occupy the building at 50-60 Fremont Street, San Francisco, where the northern branch of the Smith Booth Usher Company was located. Speaking for the officers of the new company Mr. Jenison pledged them to the following basic principles of operation:

"1. To insure to every customer a purchase that is suited to his needs and one that in our best judgment can show him an earning to justify the expenditure.

2. To so conduct our business that we feel we have left no stone unturned to insure to each customer entire satisfaction in his business dealings with us."

The Smith Booth Usher Company will continue to serve the southern California trade from its large stocks carried at 228 Cental Avenue and 1910 Santa Fe Avenue, Los Angeles.

Home of the Jenison Machinery Co.

Distributor News is indebted to Sauerman Bros., Inc., Chicago for this story of western enterprise. Sauerman Bros., Inc., makers of dragline and slackline cable-way excavators, are one of the many equipment manufacturers whom the Jenison Machinery Company will represent on the Pacific Coast.

Carries Steel Windows by Airplane

When making town calls in the interest of David Lupton's Sons Company, Mr. Sidnor Hall, of Sidnor Hall & Co., St. Louis, drops down on his prospect from an airplane carrying with him his sample Lupton steel window.

In order to discuss Lupton windows with Bondi Brothers of Galesburg, owners of a new building now under construction, Mr. Hall flew from St. Louis to Galesburg, and as usual carried with him his sample steel window. The time-saving feature of airplane transportation is forcefully illustrated by Mr. Hall's experiences. Mr. Hall says that the Galesburg trip takes about two hours, and that long jumps can be made quickly at a low mileage cost. This saving of time spent in traveling allows for a greater length of time to be spent with the prospect. Mr. Hall's method of traveling is attracting the attention of other building supply houses.

The Thew Shovel Co. Increases Sales Force

Due to a 62 per cent increase in the sales of Lorain 75, the Thew Shovel Company has found it necessary to add to their sales force the following representatives, whose names are by no means new to the contracting and construction field:

Mr. J. H. Devine—will be located at the company's Chicago office. Mr. Devine was for several years manager of the Construction Equipment Division of the Smith Booth Usher Co., at their San Francisco office. He comes to the Thew Shovel Company with a full knowledge of their product, having sold equipment of this kind for the Smith Booth Usher Company.

Mr. A. C. McLain—will be attached to the Dallas office, under the direct supervision of Mr. V. L. Wheeler, district manager. Mr. McLain has for the past three years been associated with the White Motor Truck Company of Dallas, Texas.

Mr. D. G. Laurell—with the residence at Alcoa, Tennessee, will be attached to the Atlanta office in a sales capacity for both the Thew Shovel Company and the Universal Crane Company. Mr. Laurell for the past three years has represented the Novo Engine Company in the Southeast and prior to that time was associated with the Wagner Sales Company of Knoxville, Tennessee.

The other three additions to the sales force have been identified with the shovel industry for many years. They will be located as follows:

Mr. H. S. Beale—at the Thew Shovel Company's New York office.

Mr. R. S. Delp—at the Philadelphia office.

Mr. Malcom Jones—at the Chicago office.

Besides this large increase in the number of salesmen, the following distributors will have charge of sales and service in their respective territories:

The Southern Tractor Company, Montgomery, Alabama.

The North Carolina Equipment Co., Raleigh, N. C.

The Hall Perry Machinery Co., Butte, Montana.

The Paragon Supplies, Ltd., Vancouver, B. C., Canada.

The R. G. Moeller Company, Detroit, Mich.

The Jenison Machinery Co., San Francisco, Calif.

(Successors to Smith Booth Usher Co.)

American Tar Products Company announces that their Nashville representative, Mr. J. M. Lewis, has changed his address from 3713 Central Avenue to 1708 Villa Place.

Joseph T. Ryerson & Son, Inc., Acquires Large Plant

Joseph T. Ryerson & Son, Inc., of Boston, New York and Chicago, have acquired the plant, merchandise, and good will of the **E. P. Sanderson Company** at Third, Binney & Munroe Streets, Kendall Square, Cambridge, Mass.

The Ryerson Company, pioneer steel-service organization was founded in 1842 and have plants in Boston, New York, Buffalo, Detroit, Cincinnati, Cleveland, Chicago, and St. Louis.

They have been operating on leased property at 675 Concord Ave., Cambridge, since May 1, 1926. This move will give them a large increase in plant facilities and tonnage. By the combination of the Ryerson Sanderson organization and the addition of new lines, the Ryerson Company will be in a much better position to give a broad line of service in keeping with the high standard built up through their many years of business.

The E. P. Sanderson plant is the largest and most complete of its kind in the New England territory.

The officials of the Sanderson Company are sending out a letter recommending the Ryerson Company to their customers, inviting a continuance of the same friendly patronage in the future that they have enjoyed in the past.

Both the Ryerson and Sanderson companies have specialized in the immediate shipment of everything in iron and steel. The following list is typical of the products which they regularly carry in stock and ship on a moment's notice:

Steel bars	Steel sheets
Reinforcing bars	Steel plates
Shafting	Boiler tubes
I-beams	Rivets
Channels	Bolts
Angles	Nuts
Tees	

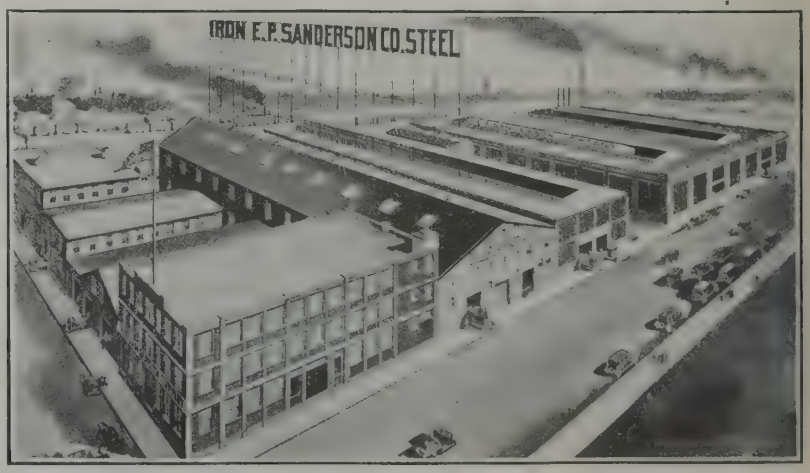
and hundreds of other allied products.

These large stock sources make it unnecessary for manufacturers and builders to maintain their own stocks with consequent high cost of storing, handling, cutting, etc. There is also loss due to depreciation and waste. Firms of this kind fit well into the modern hand-to-mouth buying policy of industry by making it practical and profitable to depend upon one centralized warehousing source for current material and in this way keep all capital available for operating and increasing business.

Distributor Notes

The Trackson Company, Milwaukee, Wis., manufacturers of Trackson full-crawlers, loaders, shovels, cranes, etc., announces the appointment of the following distributors who will handle their lines of Trackson equipment in the east: Industrial Tractor Sales Co., Inc., 500 Fallsway, Baltimore, Md.; E. B. Kelly Co., N. Broadway, Box 22, Albany, N. Y.; W. B. May, Inc., 41 Perry St., Buffalo, N. Y.; Truck-Tractor Equipment Co., 460 Neilston St., Columbus, Ohio; Tractor & Equipment Co., 520-522 Passaic Ave., Newark, N. J.; and Service Supply Co., 20th and Venango Sts., Philadelphia, Pa.

Pardon Manufacturing Company, Arlington, N. J., announces the appointment of Mr. F. W. DuBois of the American Pump & Supply Co., General Motors Building, Detroit, Mich., as sales representative.



Steel Plant of the E. P. Sanderson Company, Cambridge, Mass., Recently Acquired by Joseph T. Ryerson & Son, Inc.

Trade Publications

The following trade publications of interest to municipal engineers, waterworks engineers and contractors, sewage engineers and contractors and others in the municipal field, have been received. Copies may be secured upon application to the manufacturers named.

Culverts and Drains.—Armco Culvert Manufacturers' Association have just issued a new booklet, Bulletin H-34, taking for its subject "Selecting Culverts and Drains on the Basis of Cost per Year." The factors contributing to the low annual cost of Armco Culverts and Drains are listed as follows:

Moderate first cost or purchase price
Low cost of transportation from factory to site
Low cost of installation—ease of handling — minimum excavation — immediate backfill—self alignment —long sections—simple connections
Low maintenance cost—no repairs—no painting — no repointing of joints—no replanking
Low cost of retirement—long life—highway salvage value

Each factor named is subjected to careful analysis, and charts and tables are given to prove that "true economy results from the selection of that type of culvert or drain which is lowest in yearly cost, as tested out by actual service." The bulletin contains many illustrations to emphasize the points brought out, and much interesting information in regard to the use of Armco corrugated pipe.

Cast Iron Pipe.—McWane Cast Iron Pipe Company of Birmingham, Ala., have issued a very complete 44-page booklet describing their products, bearing the date of September 1st, 1928, and ask that all previous issues be destroyed. The booklet is well indexed so that the busy contractor can turn at once to the product he is seeking. The booklet states what McWane Pipe is, what it does, new fields for its use, style in which it is cast and the fact that it is approved by the Underwriters' Laboratories of the National Board of Fire Underwriters. The booklet contains many illustrations and cross-sectional drawings with tables of specifications.

Concrete Pipe.—McCracken Machinery Company, Sioux City, Iowa, have issued a booklet on McCracken Concrete Pipe Machinery which is worthy of special mention. It is a loose leaf style, bound in attractive scarlet covers with black lettering. The book is handsomely illustrated and well printed on heavy enamel paper. It describes first the four outstanding methods now in use by manufacturers for the making of concrete pipe, followed by the story of how McCracken Pipe are made. Then comes the history of the various McCracken plants throughout this country and foreign lands, with a special article devoted to the market for the pipe. McCracken machines are sold with territorial protection so that no competitor can operate a McCracken machine in the same district.

Moturbo Deep Well Turbine Pumps are described in a 52-page catalog issued by the Peerless Pump Company of Los Angeles, Calif., and Massillon, O., with branch offices in the principal cities of the country. The catalog contains a complete index by paragraphs, each paragraph bearing a subject title and number. Construction, driving mechanism, operation, performance, durability, lubrication, readjustments, etc., are all treated in their order. Several pages are devoted to tables and information necessary for solving hydraulic problems.

Concrete Wells.—Kelly Well Company with main office at Grand Island, Neb., offers a descriptive and illustrated catalog of Kelly Concrete Wells. It contains interesting information regarding construction and installation, and offers without obligation to advise regarding well matters in any way possible. The booklet is written in a very interesting manner and is full of good information.

Diesel Oil Engines.—New Economy in Power is the title of the catalog recently issued by The Buckeye Machine Company which explains in detail the construction of the machine as well as giving considerable data on installations in many localities, and in many vocations throughout the country. The subject of each paragraph is carried in a word at the beginning which makes it easy to turn to the points in question. The booklet, which contains 28 pages, is very handsome in appearance.

Valves.—Golden-Anderson Valve Specialty Company located in the Fulton Building, Pittsburgh, have issued a descriptive and data catalog on their automatic valves for steam and water service. Full details are given on each page as to construction, operation and variations together with cross-section drawings. Data required for ordering is made very clear.

Recording Meter.—The Tanner Engineering Company, Inc., Long Island, New York, have a folder describing the Tanner Remote Recording Meter and Tanner Remote Indicator. The meter is used for remote recording of level of water or other liquid in storage tanks, brine tanks, reservoirs, ponds, hydroelectric plant head water, tail water; position of head gates, pen stock valves, gas tanks; and for recording any straight line or angular motion or displacement. It is of the circular chart type using an eight inch chart and can be supplied with a twenty-four hour or a seven day clock, either clock running eight days with one winding. The indicator with transmitter provides a means of indicating at the switchboard or central control position many of the plant conditions not previously attempted. The distance to which indications can be transmitted depends only on the length of transmission wires that can be strung. This may be from a few feet to several miles.

Steel Windows and Doors. — The Truscon Steel Company, Youngstown, Ohio, puts out two very complete catalogs, No. 110 and 126, describing their steel windows and doors respectively. These steel windows are designed for maximum daylight and positive control of ventilation in industrial buildings with sawtooth or monitor type roofs. Merely by the pressing of an electric button an entire roof can be made to open and close or each panel can be operated separately to meet the needs of any local situation in the factory. The doors are made in many types; the stock type carried for immediate delivery is recommended for use in basements, furnace and boiler rooms, fire exits, service entrances, etc.; industrial type, vertical folding, vertical lift, vertical-lift swing type, fire department and airplane hangar doors. Full descriptions with many illustrations of the various types are to be found in these catalogs.

Heavy Duty Trailers.—Rogers Brothers Corporation of Albion, Penna., makers of Goose Neck, Heavy Duty Trailers have issued a 32-page booklet picturing and describing their product. It is issued as Catalog No. 28 and calls attention to the fact that this company are pioneers in the manufacture of heavy trailers for moving all kinds of heavy machinery and road equipment. They enumerate ten "firsts" which they originated in the development of trailer equipment.

Rock Drills.—Gilman Manufacturing Company, East Boston, Mass., makers of rock drills and mining machinery in their Bulletin No. 100, issued in the popular loose leaf style, fully describe and illustrate their hand held rock drills. No. 101 is devoted to mounted rock drills, and No. 103 treats of the Gilman Automatic Heat Treating Machines for rock drill bits. A vast amount of research by the Gilman engineers is evident from the result attained.

Mixer Heaters.—Chausse Oil Burner Company of Elkhart, Ind., has just issued Circular No. 14 describing several models of their mixer heaters, and kerosene torches. Mention is also made of their tar kettles, tool heaters, oil-burning surface heaters, self-heating smoothing iron and the Chausse portable asphalt plant.

Centrifugal Pumps.—Lawrence Pump & Engine Co., Lawrence, Mass., have issued a folder in loose leaf style of the Lawrence "Vortex" Centrifugal Pumps. This folder contains Bulletins D-20, D-25, D-28, D-30, giving full descriptions of single stage, double suction horizontal split casing high efficiency pumps. Bulletin D-25 is devoted to gasoline engine driven centrifugal pumping units, Bulletin D-28 describes

sand and dredging pumps, D-30 represents the latest development in the design of pumps for handling pulp and thick stock in paper and pulp mills, and the "Vortex" cellar drainage pump.

Dump Bodies. — The Commercial Shearing & Stamping Co., of Youngstown, Ohio, in a handsome 16-page booklet, The "Commercial" 3 Way, calls attention to the special features of the 3-Way Hoist and Dump Bodies, allowing dumping from either side or the rear, operating from the driver's seat, with a safety locking device. The booklet is well illustrated, showing the trucks at work, and gives tables with details as to sizes and capacity, as well as a useful table of weights and information on various materials.

Chemicals.—Building Chemicals Corporation, 51 East 42nd Street, New York, has prepared a catalog of chemicals for building construction for the use of architects, engineers and contractors. The foreword of the catalog states: "All materials in this catalog are made to conform with the specifications and recommendations of the Department of Commerce, Bureau of Standards, Washington, D. C., where they are available for the subject. Because we believe that these organizations are unbiased, thorough, and acting for the best interest of all industry, we have selected them as a guide and have given every consideration to their findings in preparing the products of the Building Chemicals Corporation." The catalog contains a table of contents and a complete index of products and their uses. The titles and paragraph subjects are so set up as to make it very easy to find the information sought. A useful catalog for the purpose intended.

Celite Folder No. 338 issued by the Celite Products Company of Los Angeles, is called "Better Concrete—at less cost." The folder contains 12 illustrations to bear out this point. There is an article on "Workable Concrete" with a table giving the amounts of Celite used in the more common mixes. Celite is a specially prepared grade of diatomaceous silica of high purity and extreme fineness. Being composed of practically pure silica, it is a permanent ingredient in concrete. A very complete description of this product is found in Bulletin No. 339 issued by the company. This bulletin contains detailed discussions on how Celite functions regarding workability, watertightness, water-cement ratio control, etc.

Direct Current Motors.—The Louis Allis Company of Milwaukee, Wisconsin, recently issued a bulletin on direct current motors (No. 507). The bulletin contains full description of the many special types of L-A direct current motors for every industrial need.

Fiber for Street Sweepers.—This is the title of an attractive little booklet issued by the Huntsville Fiber and Veneer Works of Huntsville, Alabama. It is well named for it is a fascinating little story book, well illustrated. It is the history of "Faultless Fiber for Street Sweepers" made from Huntsville Hickory. In a foreword Frank H. Ford, president of the company, which was established in 1899, sets forth the claims made for Faultless Fiber, which carries an unconditional guarantee on each bale shipped. Mr. Hunt states: "We could produce a cheaper product—but it would be a different product, which could no longer be guaranteed." Following the introduction is a detailed description of the manufacture of the product from the gathering of the raw material, which comes from the Cumberland Mountains fringing the Tennessee River, to the time it is baled for shipment ready to be made into the sturdy and reliable street sweepers. Each step of the process is pictured: the lovely woodland; cutting the logs; inspection; seasoning (in large boiling vats); "barking" ready for veneering; cutting; "shaking"; drying, etc. The booklet carries conviction for the product and creates a desire on the part of the reader to visit the mill. In addition to the supervision of the manufacturing process, Mr. Ford has now taken over the full distribution, and orders sent direct to the mill will be filled and shipped out promptly. A year-round delivery system has been inaugurated, which will insure shipments going out at regular intervals, thus taking care of the needs of the user at a minimum of storage space. Mr. Lawrence Cooper serves the company as vice-president and Mr. E. R. Ford as secretary.

Industrial Motors. — Synchronous motors is the subject treated in a large well-illustrated book now being distributed by the Electric Machinery Manufacturing Company of Minneapolis, specialists in the manufacture of this type of electrical equipment. The book deals with the application of these motors with special reference to the needs of executive and plant managers. "The Most Effective Drive in Industry," as the new book is called, contains 56 pages and 85 illustrations. The advantages of the Synchronous Motor in comparison with other types, the theory of its operation, and its development to present high efficiency are well covered, while the last half of the book is devoted to scores of applications.

Rock Drills.—Ingersoll-Rand of New York, with offices in all the principal cities of the world, have issued a new folder describing their rock drilling outfits, a combination of the I-R "Jackhamers" and portable compressors.

Full Width Bituminous Distributor.—Catalog No. 503 describing the Model "F" distributor has been received from E. D. Etnyre & Company, Oregon, Illinois. Model "F" is a separate engine-driven pump type of distributor for the application of all grades of oil, tar and asphalt used for bituminous road construction and maintenance. The outstanding feature of this model is the full width application through the use of wider spray bars than have formerly been employed. The catalog is well illustrated, giving cross sections of parts in detail, and many views of the Etnyre in action. Bulletin No. 301 issued by the same company describes the Etnyre two-motor system of street flushing. The advantage of being able to regulate the speed of the pump independent of the speed of the truck is apparent, because the amount of water that is required to clean a street depends entirely upon the condition and amount of accumulation. The bulletin gives full descriptions, specifications and illustrations of Etnyre Flushing and Sprinkling Units.

Excavators.—Bulletin No. 2805 recently issued by the General Excavator Co. of Marion, O., and which carries at the top of every page the medallion head and royal insignia of the Little General himself, is a very attractive looking 20-page booklet, well printed on heavy enamel paper with a gray cover printed in red and black. The centerspread shows nineteen illustrations of "General Excavators on All Kinds of Work—Handling Every Job Efficiently and Well." The bulletin contains detailed description of all parts.

Chlorinizer.—Paradon Manufacturing Company, Arlington, N. J., have issued Bulletin No. 281 describing the Paradon Chlorinizer, a new type of chlorinating apparatus for the sterilization of small water supplies, small sewage flows and small swimming pools. The Chlorinizer can also be used for the application of various chemical solutions in small amounts.

United Hoisting Company, Inc., 136th St. and Locust St., New York City, has been representing Sullivan Machinery Company for several months as distributor for their construction equipment, including vibrationless portable compressors, rotator rock drills, turbinair portable hoists, all-hammer drill sharpeners and drill steel furnaces. They also manufacture busters, concrete breakers and clay diggers.

Sullivan Machinery Company is represented in Salt Lake City by the Utah Eastern Iron and Metal Company, and in Sacramento, California, by the Standard Equipment & Supply Co.

William Hamilton, Ltd., of Peterborough, Ontario, with branches in Montreal, Vancouver and New Glasgow, Nova Scotia, have taken over the distribution of Lidgerwood machinery in Canada. William Hamilton, Ltd., are also represented in Winnipeg; Kipp-Kelly, Ltd. handling their sales in Manitoba.

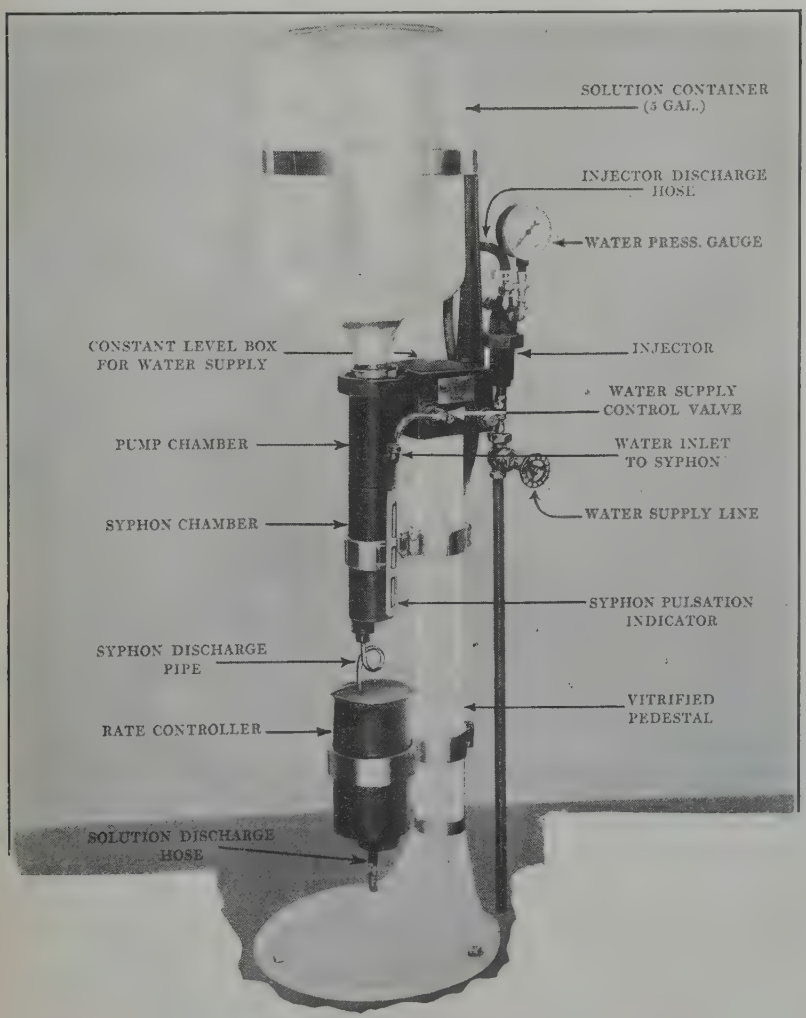
New Type Chlorinator and Chemical Solution Feeder

The Paradon Manufacturing Co., Arlington, N. J., have developed a novel device known as the Paradon Chlorinizer for the application of prepared chlorine solution and other chemical solutions, in small amounts, which heretofore could not be directly applied on account of the very small orifices and valves necessary.

The primary solution (generally prepared chlorine solution) to be applied, is contained in an inverted 5-gal. carboy. The partial vacuum in the top of the inverted carboy maintains a constant level of solution in a small reservoir, known as the pump chamber, located beneath the carboy. A second chamber, called syphon chamber, is intermittently emptied by an automatic syphon operated by a small auxiliary water supply. This syphon chamber is connected by a tube (meter) with the pump chamber. When the syphon chamber is emptied, a constant volume of air is trapped in the meter tube leading to the first reservoir. As the syphon chamber fills, this air is forced into the pump chamber. It displaces a corresponding volume of solution from the pump chamber, forcing this solution out through an overflow into the syphon chamber.

From the syphon chamber, water plus the chemical is discharged into a chamber, designated rate controller. The purpose of the rate controller is to maintain a uniform discharge of chemical solution, the inflow to the rate controller of course being intermittent. The rate controller also acts as a water seal to prevent air from being admitted to the system into which application is to be made.

The solution ordinarily flows by gravity from the rate controller to the point of application. If, however, the desired point of application is under a pressure sufficient to render gravity flow impossible, an injector is used, drawing the solution from the rate controller, and discharging it at the point of application.



New Chlorinator Recently Perfected by Paradon

The Chlorinizer is, in reality, an automatic diluting device. The amount of chemical applied, viz., the amount of dilution of the primary chemical solution by the auxiliary water supply depends on the strength of the primary solution, on the number of pulsations of the syphon per unit of time, and on the size of the meter tube. For any given operation, the strength of primary solution, and the size of the meter are constant; hence the only variable is the number of syphon pulsations. The number of syphon pulsations is regulated by the flow of water to the syphon chamber. This flow of water depends on the opening of the water supply control valve, as a float chamber maintains a constant head on the water supply control valve. A gauge glass indicates the number of syphon pulsations.

The Chlorinizer is especially designed to apply small dosages of prepared chlorine solution and other chemicals. There is practically no minimum dosage, as the concentration of the primary solution can be as small as desired. For any given meter tube, the maximum capacity is approximately five times the minimum. Meter tubes of various capacities can be used, as these meter tubes can be quickly changed. Chlorinizers have been constructed with meter tubes having as small a capacity as 5 gal. per 14 days, and as large a capacity as 5 gal. in 6 hours. At maximum operation, the syphon requires about 200 gal. of water per 24 hours for operation. Minimum requirements are about 50 gal. of water per 24 hours. The water supply need not be under pressure. The Chlorinizer can be adapted to automatic operation by having the amount of auxiliary water supplied to it a proportional factor of the total flow to which the chemical is to be applied. Automatic start and stop operation is very simple with the Chlorinizer. It simply requires that the auxiliary water supply for operating the syphon be taken from a point at which there will be no flow of water when the pump, etc., stops operating.

Advantages claimed for the Chlorinizer, as reported by the manufacturers, are that it is hydraulic in operation, it has no moving parts, it operates simply by turning on and off a water faucet, there are no valves nor other mechanical devices to come in contact with the chemical, and the number of parts of the Chlorinizer is the smallest of any similar device on the market.

On account of its hydraulic operation, the Chlorinizer can be made of silver and hard rubber. No other metals are required. Corrosion by chlorine is eliminated. Automatic stop and start operation is secured without any special devices. The Chlorinizer is mounted on a handsome, white vitrified enameled pedestal.

The Chlorinizer is intended primarily

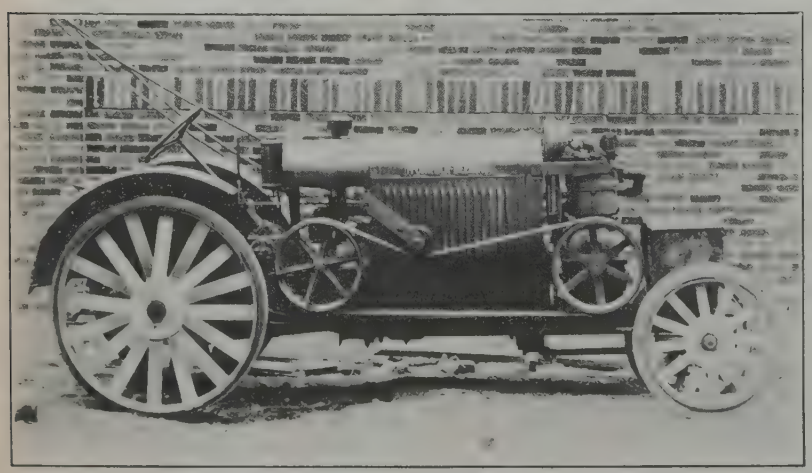
for the chlorination of very small water supplies, small sewage systems, and small swimming pools, by the use of prepared sodium hypochlorite solution, variously known as "laundry bleach," "javelle water," etc. This solution is readily obtainable in every part of the country. The minimum capacity of the Chlorinizer is practically unlimited; even a few hundred gallons a day can now be successfully chlorinated—a condition heretofore impossible with the usual chlorine gas apparatus. The Chlorinizer makes it possible to chlorinate the water and sewage systems of camps, country clubs, institutions, small towns, etc., efficiently and economically. It can also be used for the application of copper sulphate, sodium aluminate and similar chemical solutions.

Several Chlorinizers have been in operation for approximately nine months.

Air Compressor Mounted on Tractor

A self-propelling four-wheel air compressor, capable of handling heavy loads behind itself and move about on the job under its own power, is being manufactured by the Pontiac Tractor Co., Pontiac, Mich.

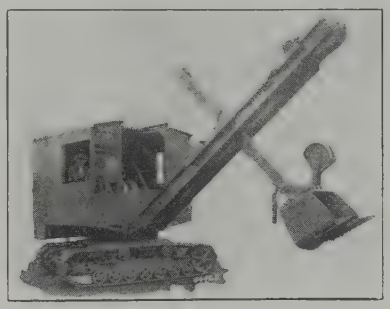
The compressor is a Quincy Type W-4 of 124 cu. ft. displacement, having a separate radiator with pump-driven circulation. This holds the temperature of the air coming from the compressor 60 to 70 deg. below the temperature of compressors which are cooled from the motive-power radiator. The compressor has a three-bearing crankshaft and force feed lubrication. This unit is controlled by a Penn unloader with hand unloader attachment. The compressor with air tank and tool box mounted on a frame which attaches to either the McCormick-Deering or Fordson tractors. Power is taken from the tractor to drive the compressor through the power takeoff pulley, which has a clutch allowing it to be thrown out or into gear at will. The "ahead" drive of the belt brings the belt tightener into the correct relation with the belt.



New Outfit Composed of Compressor Mounted on Tractor

New Insley Excavator

The Insley Manufacturing Co., Indianapolis, Ind., announce the new full revolving Insley excavator to be known as the Type "R." It is made with five attachments, the shovel, ditcher, skimmer, crane and dragline, all of which are interchangeable. The Insley Type "R" has many features of advanced design, including roller bearings for all shafts above the revolving frame, cut gears throughout, cast steel carbody, cast steel machinery base and side frames, separate control for each crawler, and one shot lubrication for crawler rollers. A special feature of the Insley Type "R" is the use of hydraulic brakes which operate separately on each crawler, and which are controlled from the operator's platform. These brakes operate as effectively in one direction as in the other, eliminating the necessity of dogs or checks. Power can be applied to each crawler separately from the operator's platform.



Type R Insley Excavator

Another feature of the Insley is the swinging, which is 5 rpm., which, combined with the line speed, gives an exceptional operating speed. It has a tail swing of only 7 ft.

The Insley Type "R" shovel uses the Insley patented cable crowd. The standard shovel boom is 17 ft. 6 in. long, giving a dumping clearance of 12 ft. 6 in., or the shovel can be equipped with a high lift boom and dipper for any clearance up to 15 or 16 ft. It has a gear driven power boom hoist which is self-locking without the use of brakes or dogs. The ditcher uses the same boom as the shovel, and has an effective digging depth of 18 ft. The skimmer has a digging radius of 20 ft. 6 in. from the center of rotation, a dumping clearance of 10 ft. and carries a bucket with one-half yard working capacity.

The crane has a 35-ft. boom as standard equipment, and can be equipped with a longer boom if necessary. Its capacity is 5,200 lb. at 18-ft. radius, 4,500 lb. at 20-ft. radius and 2,500 lb. at 30 ft. It has more than ample capacity to handle a ½-yd. clamshell. The power boom hoist mentioned is of great value on crane work, as the boom can be raised and lowered under a load. The dragline uses the same boom as the crane and a bucket having a half yard working capacity.

Prest-O-Lite Flood Light Attachment

The Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City, announces a flood light attachment of new design for use with the familiar small tanks of dissolved acetylene, the same as are used for truck and tractor lighting.

Prest-O-Lite gas tanks are available from service stations throughout the country. By the connection of the attachment a convenient, portable, powerful flood lighting unit is obtained which can be used for illumination in

New Flood Light Attachment Recently Announced by Prest-O-Lite

dark places and for facilitating night work of all kinds.

The improved attachment, illustrated herewith, is of simple, strong, rigid and compact construction. Universal adjustment is obtained with only one swing joint, this minimizing the possibility of leakage, it is said.

Because of the substantial construction of the new part and because of its position near the center line of the tank, the attachment itself can be used as a handle in carrying the entire unit, says the manufacturers.

The reflector, which is 10 in. in diameter, can be taken off by removing a single knurled nut. A new type of burner is used which will not "carbon up," says the manufacturers. This burner is placed at a fixed focal point and requires no adjustment, it is claimed.

Barber-Greene Trench Digger on Schacht Truck

The installation of a Barber-Greene trench digger on a Schacht truck chassis, as shown in the accompanying photograph, is the first application of this kind and is said to be proving an unusually effective combination in the service of O'Connell & Sweeney, general contractors of Cincinnati, who conceived and patented the idea which was worked out in collaboration with George Mueller, chief engineer of The LeBlond-Schacht Truck Co., and the Barber-Greene Co.

The building of this outfit was the result of practical necessity, as O'Connell & Sweeney have a two-year contract with the City of Cincinnati to make all taps in city streets for water connections. In view of the fact that these taps are made in all parts of the city, the need was felt for a digging outfit that could be transported rapidly from one job to another.

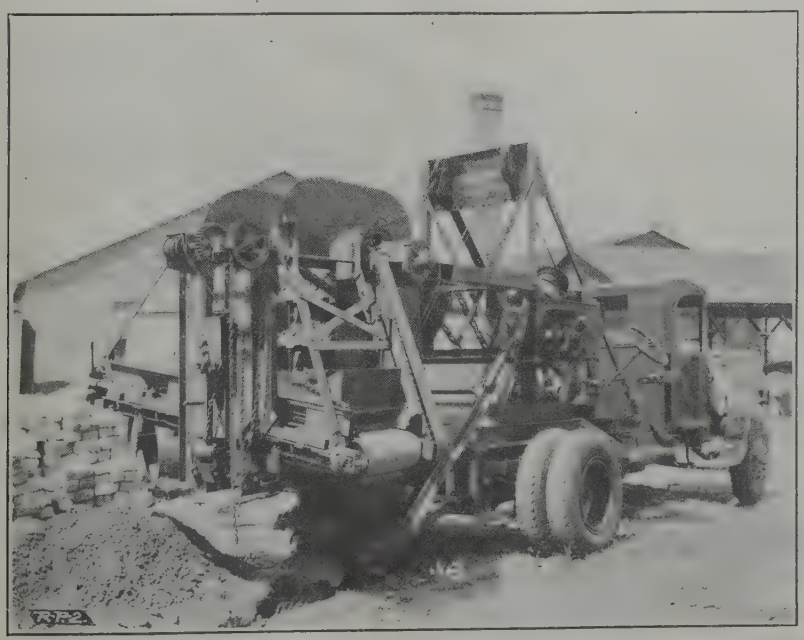
A special transmission with an exceedingly low gear reduction permits a digging speed of 1½ ft. per minute. With this outfit only 1½ minutes are required to dig a trench 4 ft. long, 4 ft. deep and 2 ft. wide. The maximum road speed when traveling from one job to another is approximately 18 miles per hour.

One operator can handle and control the complete outfit. A seat is provided on the right-hand side of the chassis, from which the operation of the digger is controlled, as well as the forward movement of the chassis. An auxiliary steering gear is also provided at the side to control forward movement of the truck when digging.

The chassis is of 3½-tons capacity with a wheelbase of 172 in. It is equipped with a 5-ton engine governed to 1,000 r.p.m. at which speed it develops 60 h.p.; 36x8 pneumatic tires (duals rear) provide the necessary traction when operating in soft places and also permit faster running speed when going from job to job.

In view of the exceptionally low gear reduction with which the chassis is provided in order to make possible the slow speed of 1½ ft. per minute when the digger is in operation, it has been necessary to install a safety joint in the drive shaft which will shear off if for any reason the rear wheels become obstructed by an immovable object thereby preventing the possibility of transmitting a destructive force to the differential gears.

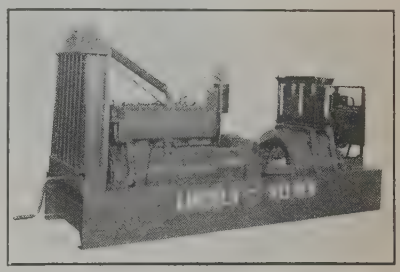
The utility of this outfit has been given a practical test by O'Connell & Sweeney and has been entirely up to every expectation, it is said. As many as 43 openings have been made in a single day, yet with this outfit the services of only one man are required. This naturally results in a material saving to O'Connell & Sweeney, in addition to their ability to give better service to the City of Cincinnati.



Trencher Mounted on Truck, Operated by O'Connell & Sweeney, Cincinnati

Lincoln Electric Announces New Welder

The Lincoln Electric Co., Cleveland, O., recently announced a new 300-ampere gasoline engine driven welder, known as Model S-1964. The welding generator is rated at 300 amperes in accordance with N. E. M. A. Standards and has a current range of from 75 to 400 amperes for metallic electrode welding, and is direct connected to a six-cylinder Buda Model HS-6 engine, operating at 1,500 r.p.m.



New Gasoline Engine Driven Welder Announced by Lincoln Electric Co.

Both units are mounted on a welded steel base, thus giving maximum strength and rigidity with minimum weight, says the manufacturers.

The engine has an S. A. E. rating of 27.3 h.p. and gives a brake horsepower of 41 while running at the operating speed. It is said to be very economical in gasoline consumption. The gas tank is located in the channel iron frame under the engine, thus eliminating fire hazard.

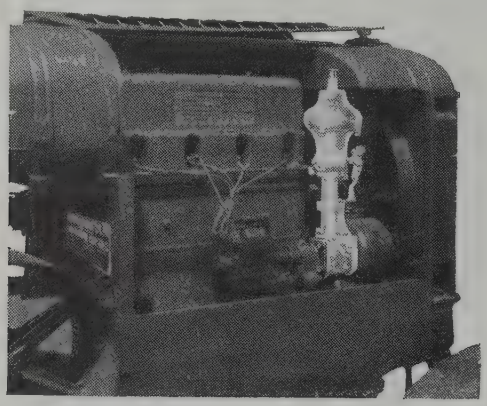
The generator has the laminated magnetic circuit with separately excited field, stabilizer, variable voltage and steel construction features characteristic of the company's line of "Stable-Arc" Welders.

The overall dimensions are 93 in. long, 35 in. wide, with an overall height of 45 in.

The equipment has been designed to meet the constantly increasing use of larger electrode in welding, and the six-cylinder performance gives a smooth, even flow of power so necessary for successful welding.

Pickering Governor Now Built for Tractors

Pickering governors, for many years standard equipment for steam equipment, are now available for Fordson, McCormick-Deering, Hart-Parr, Twin City, and other comomnly used makes of tractors. Retaining the spring-principle head, this unit operates through a positive drive and does not retard fuel flow, according to the manufacturers.



New Pickering Governor for Tractors

The purpose of the governor is to provide a steady flow of power at all times by adapting engine speed to load automatically, thus avoiding possibility of stalling when the tractor is suddenly subjected to overload, and to provide more ecomonical operation by this adaptation of the power to the load. Important fuel savings have been reported. Due to the avoidance of racing of the engine, repairs are minimized, according to the manufacturer.

On some tractors, this governor is installed in place of the governor regularly supplied by the manufacturer of the tractor, while in others the old governor is simply disconnected and the new one mounted in a different manner. In any case, the governor is supplied complete and ready for installation, and can easily be mounted and put into service in about an hour by any man familiar with the tractor and handy with tools.

These governors, that are said to radically improve the service and increase the efficiency and economy of the tractor, are manufactured by the Pickering Governor Company, Portland, Conn.

A Large Capacity Kerosene Torch for 1-Man Operation

Increasing use of kerosene torches in a multitude of industrial, railway and highway services has resulted in production of these torches with large capacity tanks which are too heavy for one-man operation. To avoid necessity for the employment of two men in using such kerosene burners, the Chausse Oil Burner Co. of Elkhart, Ind., has announced a model arranged similarly to a wheelbarrow. This outfit can be easily transported by the man who requires it in his occupation.

A conventional type welded steel tank with capacity of 14 gal. of kerosene is mounted in tubular steel shafts with a single wheel. To the tank, which has a self contained air pump and pressure gauge, is attached the kerosene burner by means of heavy duty pneumatic tool hose. The burner handle is steel, with wooden grip and convenient needle valve.

This burner is self generating and produces a heat temperature from 1750 to 1800° F. The volume of gas is considerable and is stated to makes this outfit adaptable to such work as preheating prior to welding, thawing frozen piping, melting snow on tracks and switches, and wherever an intensely hot voluminous flame is desired.

New Oil Burning Torch

$330,000,000 of Highway Bond Issues to Be Voted On.—The election of a President is not the only important issue facing the voters at the coming election. Bond issues for highway improvements, totaling the sum of $330,000,000, will be passed on by voters in the various states.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUG. 24, 1912,

Of Municipal News and Water Works, published monthly, at Hammond, Indiana, for Oct. 1, 1928.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. S. Gillette, who, having been duly sworn according to law, deposes and says that he is the Business Manager of Municipal News and Water Works and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., the aforesaid publication for the date shown in the above caption, required by the Act of Aug. 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher—Gillette Publishing Company, 221 East 20th St., Chicago, Ill.

Editor—C. T. Murray, 221 East 20th St., Chicago, Ill.

Managing Editor—H. P. Gillette, 221 East 20th St., Chicago. Ill.

Business Manager—E. S. Gillette, 221 East 20th St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Gillette Publishing Company, 221 East 20th St., Chicago, Ill.

H. P. Gillette, 221 East 20th St., Chicago, Ill.
E. S. Gillette, 221 East 20th St., Chicago, Ill.
Mrs. R. W. Hume, 303 S. Stone Ave., LaGrange, Ill.

Winifred Gillette, 717 Bonita Drive, So. Pasadena, Calif.

Commonwealth Title Ins. & Trust Co., Chestnut and 12th Sts., Philadelphia, Pa.

Louise Forsythe, 13 E. Windermere Terrace, Lansdowne, Pa.

LaVerne Louer Hellyer, Ambassador Hotel, Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only.)

E. S. GILLETTE,
(Signature of Business Manager.)

Sworn to and subscribed before me this 29th day of September, 1928.

KITTIE O. WOULFE,
(Seal) Notary Public.
(My commission expires Feb. 9, 1930.)

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

To Our Readers

Distributor News is now one month l having appeared in each of our onthly publications. But, this is a ort time in which to become ac- ainted with 73,000 readers, the num- r to whom The Gillette Construction roup of magazines goes. Of course, t all of this large number are di- ctly interested in the distributor ction, but we hope all of our readers ll look it over, for there is bound to an item from time to time of in- rest to every one. It is a business set to know with whom you are competing and Distributor News is the place to become personally acquainted with your friends and competitors.

Up-to-date our distributor friends from the far west seem to be a little ahead of other sections in number of stories telling of their organizations and growth. Distributor News congratulates the Pacific Coast on the business enterprise described in the stories coming our way. We should like to hear from other sections of the country with stories to match those of the west. Send in pictures of your warehouses and little sketches of your sales managers, with photographs if you care to present them.

Take advantage of this department, which is at your service. Create in it such a lively reader interest that it, too, will become a warehouse—not for equipment—but for information of interest to every equipment manufacturer and distributor. Send in your items of personal news, stories of your business growth, questions you would like to have answered or letters which you believe would be of interest to others in your field. Address all communications to Editor, Distributor News, Gillette Publishing Company, 221 East 20th St., Chicago.

Hunter Machinery Company Reports a $1,000,000 Year in Michigan

THE Hunter Machinery Company, large distributors of construction uipment, incorporated under the laws both Michigan and Wisconsin, an- unce 1928 to be one of the most suc- ssful years in their history.

The Michigan company's new plant at etroit met with such immediate suc- ss that the sales volume for the first ar is reported as considerably over ,000,000. Following the successful sults of the opening of the Grand apids office in 1926, the capital of the ichigan corporation was increased to fully paid up capital of $250,000, in der to accommodate the growing siness.

Mr. M. R. Hunter, president of the mpany, reports that the Detroit plant s been doubled and additional ground rchased to the south of the main ilding. The display room has a 100- frontage on Waterman Ave., and is o stories high, in order to take care Northwest cranes, Rex pavers and ner equipment carried in stock. The ant includes a large modern parts om, and at the rear of the building ere is a two-story shop of fireproof nstruction. Both buildings are of ck, concrete and steel. Mr. Hunter tes that additional ground has been cured at Grand Rapids, doubling the ldings of that plant, and an addi- nal building is under construction ere.

Announcement is made that Mr. Alex. C. Duncan has joined the sales force the Detroit plant. Mr. Duncan for the past twelve years has been engaged in the contracting business in Philadelphia, specializing in paving.

The officers of the Michigan corporation of the Hunter Machinery Company are: Morton R. Hunter, president; B. E. Uebele, vice-president and treasurer; T. G. Abrams, vice-president in charge of sales; R. A. Arndt, assistant treasurer, and M. P. Allen, secretary.

The Wisconsin corporation announces many additions and improvements in the plant at Milwaukee. It is stated that that the 1928 sales for the Wisconsin company will exceed $1,000,000. The sales record of the Hunter Machinery Company places it in the front ranks as manufacturers' distributors, and equipment from the following plants is handled:

Atlas Motor Mixers.
Bates Valve Bag Co.
Blaw Knox Company.
Chain Belt Company.
Dure Pumps and Saw Rigs.
Cleveland Wheelbarrow & Mfg. Co.
Northwest Engineering Co.
Pulsometer Steam Pump Co.
Reynolds Portable Furnace Co.
Roos-Meyer Hecht Co.
Rowe Mfg. Company.
Sasgen Derrick Co.
Clyde Iron Works Sales Co.
Conneaut Shovel Company.
C. D. Edwards Mfg. Co.
A. W. French & Co.
Homelite Corporation.
A. Leschen Sons Rope Co.
C. A. Londelius & Co.
M. & M. Wire Clamp Co.
Mulconroy Company.
Sauerman Bros., Inc.
Sullivan Machinery Co.
Syntron Company.
Templeton, Kenly & Co.
Toledo Pressed Steel Co.
Western Wheeled Scraper Co.

J. A. Manley to Direct Fairbanks-Morse Sales

John A. Manley, who has been Manager of Sales Development for Fairbanks-Morse & Company of Chicago, for the past three years, has been elected vice-president in charge of sales, according to a recent announcement of the Board of Directors. Mr. Manley, whose career has been one of rapid advancement in the business world, was formerly Manager of Accounts for the nationally known advertising agency of Henri, Hurst & McDonald, also of Chicago. In his connection with advertising work Mr. Manley made a detailed study of the problems of industrial business development and it was the result of this work that brought him into the Fairbanks-Morse organization.

J. A. Manley, Vice-President, Fairbanks-Morse & Co.

In 1911 he was graduated from Northwestern University and entered the sales department of the Republic Tire & Rubber Co. After four years with this organization he joined the advertising staff of one of the Chicago newspapers. Later he was connected with Hart, Schaffner & Marx, studying the problems of the retail merchant, and after two years in this connection went with Henri, Hurst & McDonald.

In its varied line of products which include Diesel engines, pumps, motors, scales, railway equipment, small light plants and automatic water plants and similar items, Fairbanks-Morse & Company has an interesting sales problem. That the problem is being effectively handled under the present management is shown by the steadily increasing volume of business flowing into the Fairbanks-Morse organization.

Manufacturers and Distributors Day at the Road Show

The attention of manufacturers and distributors is called to the importance of being in Cleveland, Jan. 12. The Road Show, which is to formally open on Monday, Jan. 14, has set aside Saturday, Jan. 12, as a day to be given over to distributors and manufacturers. This will afford an opportunity for contact between manufacturers, distributors and representatives previous to the rush occasioned by the attendance of contractors and engineers after the formal opening.

A joint meeting of distributors and manufacturers will be held late in the afternoon of Jan. 12, at which there will be a short program and matters of interest will be discussed. This day, devoted to the interests of distributors and manufacturers, is an innovation for the Road Show, and the directors of the Highway Industries Association have issued a notice urging a good attendance. The announcement further states that all exhibits should be in place by the morning of the 12th.

W. A. Riddell Company Opens Branch at Little Rock, Arkansas

On November first a branch of the W. A. Riddell Company was established at North Little Rock, Ark. Mr. O. E. Tapley has been appointed branch manager. Mr. Tapley was formerly connected with the Arkansas State Highway Department, and is well known among road men, contractors and highway officials throughout the state.

The W. A. Riddell Company manufacture the well known WARCO line of road machinery, and a full line of their products will be carried by the North Little Rock branch. Graders, road rollers, wheeled scoops, full and semi-crawlers, and crawlerized tractors will will be delivered direct from the warehouse at North Little Rock. Orders for parts will also be filled by the branch. This will be a distinct advantage to the users of WARCO when in urgent need of repair parts.

The Riddell Company are pioneer manufacturers of one-man graders and announce that an extensive exhibit will be displayed at the Road Show in Cleveland, Jan. 14-18.

Truck-Tractor Equipment Co. Takes Over More Territory

The Truck-Tractor Equipment Co., 460 Neilston St., Columbus, O., well known tractor and equipment distributors, have recently enlarged their territory considerably and increased their sales activities.

Testing Out Model DH Trackson McCormick-Deering. From Left to Right: F. M. Duffy, General Manager; L. E. Andrews, Trackson Representative; Elmer E. Schatz, President Truck-Tractor Co.; R. K. Gilson, Sales Manager

In addition to the central Ohio territory, these distributors are now also covering the Cincinnati district, almost all of West Virginia, and parts of Kentucky, Maryland and Indiana. They have recently arranged with the International Harvester Co. for the distribution of McCormick-Deering Industrial tractors in these territories, and with the Trackson Company for the handling of Trackson full-crawlers, shovels, loaders, cranes, etc., which are adapted to combination with the McCormick-Deering.

The picture shows officials of the Truck-Tractor Equipment Co. testing out and admiring the Model DH Trackson McCormick-Deering unit, which has had a good sale in their territory.

It is the policy of these distributors not to sell competing lines; instead they concentrate on the sale of a few lines which have proved most suitable for their territory. The contracting, highway, and industrial fields are their most important sales outlets, and for several years they have done a good business with the Ohio and West Virginia State Highway Departments.

Timken Roller Bearing Co. Announces Expansion Program

In order to meet the ever-increasing demands for the products of the Timken Roller Bearing Company an immediate expansion of production facilities was called for. The program is now under way to provide equipment necessary to raise the present output of the company from 175,000 bearings to over 200,000 per day. During the current year an expenditure of about $6,000,000 was required to meet the needs, which covers additions to both steel mill and bearing factory.

Steel producing facilities now in operation have increased the capacity of the plant to 30,000 tons per month of high grade open hearth and electric alloy steels. The new facilities include the purchase of the plant and equipment of the Weldless Tube Company at Wooster, O., as well as additions to the mill at Canton.

Work is now under way on various extensions to the bearing factory for the machine equipment needed to take care of the increase in the production schedule.

A New Plant at South Charleston, W. Va.

The Prest-O-Lite Company has established a new acetylene plant at East Ave. and Short St., South Charleston, production at this plant starting the latter part of October. This brings the total number of Prest-O-Lite plants throughout the country up to 35. Dissolved acetylene for welding and cutting will be supplied to local industry from this point. The plant is in charge of J. J. Robinson and the district superintendent, Mr. S. P. Murphy, whose headquarters are in Cincinnati.

Notes on the Trade

Mr. H. A. Barker, a member of the Export Division of The Dorr Company, sailed for South America on October 13th for an eight months' visit in connection with his company's sanitary and metallurgical interests in that continent.

Mr. A. T. Hastings, who has for several years been manager of the Los Angeles office of the Dorr Company, sailed for Europe on October 20th to join the Dorr Company, Ltd., London. Mr. A. M. Kivari succeeds Mr. Hastings as manager of the Los Angeles office. The New York office of The Dorr Company, Engineers, is located at 247 Park Ave., New York City.

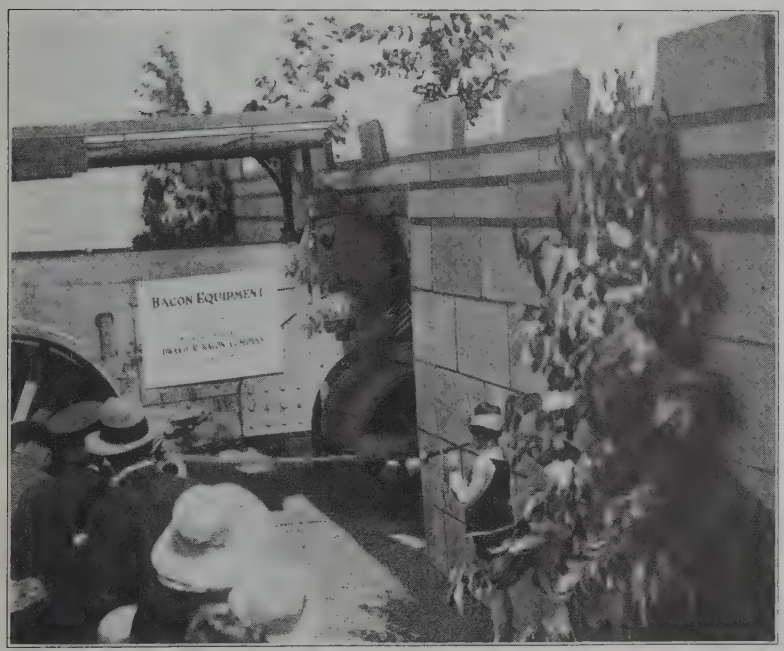
Mr. Harold C. Osman, secretary of the Nugent Steel Castings Company, Chicago, has been appointed Works Manager. Mr. Osman formerly was in charge of sales for that company.

Crashing Through

THIS title is not modern slang. It describes exactly what a 12-ton gasoline roller did to an improvised stone wall erected across Bay Shore Highway, when it was opened to traffic between the cities of San Francisco, San Mateo and Burlingame, Cal.

The opening of this new highway, constructed by the California Highway Department to provide a third outlet for vehicular traffic from San Francisco on the south, was accorded a formal arrived in time to offer his congratulations to the peninsular cities on the opening of the highway, which promises much for the future prospects of the two counties so united.

The opening of this highway was carried out in dramatic form, and the central actor was the gasoline roller, which had first built the road, and then led the procession over it. The Edward R. Bacon Company of San Francisco was the equipment distributor who furnished this piece of machinery.



12-Ton Gasoline Roller Going Through Wall to Open New California Highway

celebration early in October. The improvised stone wall across the highway was wonderfully realistic. At the command of the city attorney of San Mateo, J. E. McCurdy, "Let the barrier be broken," the big steam roller snorted and puffed its way forward, while cheers went up from a thousand throats, and the new and important link of the Bay Shore Highway was opened. Following the crash of the steam roller, a troupe of young girl dancers strewed a pathway of flowers and a long line of automobiles sped down the highway.

The 12-ton gasoline roller used to break the barrier was the one which had been used by Contractor C. W. Wood in the construction work. It was piloted by Mayor Frank Beer of San Mateo. Riding with him were R. L. Stone, acting mayor of Burlingame, and W. F. Benedict, assistant manager of the San Francisco Chamber of Commerce, representing Mayor Rolph, who was late in arriving from San Francisco, because of having to welcome the Japanese Ambassador. Mayor Rolph

Millers Falls Line of Portable Electric Tools Now Handled by Ryerson

Joseph T. Ryerson & Sons, Inc., with plants at Chicago, Milwaukee, St. Louis, Cleveland, Cincinnati, Boston, Buffalo and New York, have taken on the Millers Falls line of portable electric tools. This is a fortunate arrangement for the Millers Falls Company, of Millers Falls, Mass., as the Ryerson company have handled high grade electric tools for years, and their judgment and sales ability is particularly good in this field.

Larger Quarters

Cox & Silver, Inc., Advertising Agency, formerly located in the American Trust Bldg., have recently taken larger space in the new Watts Bldg., Birmingham. Among other accounts handled by this firm is the McWane Cast Iron Pipe Company of Birmingham.

The Clinch-Mitchell Construction Co., Successors to Flick Construction Co.

The Clinch-Mitchell Construction Company, 208 South La Salle St., Chicago, is the name of the new corporation organized to succeed the Flick Construction Company (a Delaware corporation) at the same address. This company, engaged in general railroad contracting, will have the same policy and the same officers as the former organization. The officers are: President, Mr. Edward H. Taylor; vice-president, Mr. Scott Mitchell; treasurer, Mr. Duncan L. Clinch, and secretary, Mr. Karl A. Milar.

Trackson Company Appoints New Distributors

The Trackson Company, Milwaukee, Wis., manufacturers of Trackson Full-Crawlers, Loaders, Shovels, Cranes, etc., announce the appointment of the following distributors: Brinker Supply Co., 905 Clark Bldg., Pittsburgh, Pa., and R. L. Stockard & Son, 2302 Charlotte Ave., Nashville, Tenn.

Both of these companies are well known tractor and equipment distributors handling the McCormick-Deering Industrial Tractor, Trackson equipment for the McCormick-Deering, and other related lines. They will also carry a complete stock of Trackson repair and replacement parts, and will be able to give prompt service on all orders.

New Appointments

Foster Chemical Equipment Company, 1124 Chemical Bldg., St. Louis, is the representative in that territory for the Peerless Pump Company, with factories in Los Angeles, Calif., and Massillon, O.

The Pennsylvania Pump & Compressor Company of Easton, Pa., announce the appointment of Mr. J. F. Rogers, 726 Oliver Bldg., Pittsburgh, as representative in that territory.

Mr. Gustavo Preston, 113 Broad St., Boston, Mass., has been appointed to represent the Pennsylvania Pump & Compressor Company.

Distributor Notes

Mr. Staats Abrams, distributor for Sullivan Portable Compressors and equipment, has moved his Newark office to 218 Cleveland St., Orange, N. J.

The Monongahela Supply Company has been appointed by the Sullivan Machinery Company as distributor for their products at Morgantown, W. Va. Mr. R. R. Harrison is in charge.

New and Improved Equipment for the Municipal Field

WATCH THESE TRADE ANNOUNCEMENTS FOR THE LATEST EQUIPMENT AND METHODS

The following trade publications, of interest to municipal officials, contractors and engineers, have been received. By writing the manufacturers named and mentioning this magazine, copies may be secured.

Trade Publications

Snow Removal Equipment.—The Monarch Tractors Division of the Allis-Chalmers Manufacturing Company has just issued a very attractive little booklet on Monarch Tractors for the removal of snow. The story of how to free the roads of snow in a quick and economical way is presented in this booklet. Specifications are given of Tractors "50" and "75." The Monarch Tractors Corporation of Springfield, Ill., is a subsidiary of Allis-Chalmers Manufacturing Company which is located at Milwaukee.

Playground and Water Apparatus.—Catalog No. 20 has been issued by the Ever Wear Manufacturing Company, Springfield, O. This is a 48-page, indexed, illustrated booklet, giving detailed information of playground and swimming pool equipment. 161 different models are shown, each one of which carries the company's guarantee of satisfaction. The catalog is very artistic in appearance.

Automatic Pumping.—A method used to make suction lift centrifugal pumps automatic, is treated in Bulletin B-H 850 just issued by Barrett, Haentjens & Co., Hazleton, Pa. The unit described in this booklet is of general interest. The subject is so clearly presented that it can be easily understood by the average mechanic, electrician or even a non-technical reader. The method of starting and stopping of the centrifugal pump by a float switch, push button, pressure regulator or time switch is plainly shown. The way in which the pump is primed is explained, as well as devices to protect the pump and electrical equipment against damage due to loss of prime, suction air leaks, a broken discharge pipe, and many other adverse operating conditions. A request addressed to Mr. W. A. Cather, Sales Manager of Barrett, Haentjens & Company, Hazleton, Pa., will bring you a copy of this bulletin. In writing ask for Bulletin B-H 850, mentioning the name of this magazine.

Clarifiers.—The Dorr Company, Engineers, 247 Park Ave., New York City, issue a sanitary engineering bulletin describing the applications and advantages of Dorr equipment in water treatment work. This company has branches in the principal cities of this country as well as in Europe, Africa and Australia. Write to the local office of this company or to Mr. F. H. Jones of the New York office for a copy of this bulletin. It would be appreciated if you would mention the name of our magazine when writing.

Chemicals.—This is the title of a very handsome catalog issued by the Kalbfleisch Corporation, 200 5th Ave., New York. Printed on heavy enamel paper, buff bordered, with display type in blue, and heavy blue cover, its eighty-four pages make a strong appeal for the reader's interest. This corporation has a background covering a period of a century of identification with the chemical industry of the United States. The first part of the booklet is devoted to the sources, manufacture and uses of chemicals, and a long list of chemicals manufactured by this company; industrial chemicals—chemicals for paper industry and miscellaneous chemicals. The tables at the back of the book give atomic weights, corrections for temperature, and many other tables to serve the chemical user.

Caterpillar Tractors.—Issue No. 32 of The Caterpillar Magazine presents concrete stories and illustrations of the almost endless uses to which the Caterpillar can be put. Particular attention is called to the service of this piece of equipment for airport building, and the fact that "every dropping off" place may soon become a "dropping down place" necessitating the building and maintaining of airports. Write to Mr. W. H. Gardner, San Leandro, Calif., for further information and a copy of the magazine, mentioning our magazine.

Efflorescence on Masonry.—The American Face Brick Association has prepared a brochure presenting the outstanding facts about the occurrence of afflorescence on masonry walls and how to avoid it. Two investigations were conducted for the association at the National Bureau of Standards, U. S. Department of Commerce, Washington. The investigations reported were made by L. A. Palmer, Research Associate, under George K. Burgess, Director of the Bureau of Standards, and the Research Committee of the American Face Brick Association, composed of F. W. Butterworth, Wm. C. Koch and L. B. Rainey. American Face Brick Association, 130 North Wells St., Chicago, will furnish this book on request for "Wet Walls and Efflorescence." The booklet contains 55 illustrations to show the points discussed.

Wrought Iron Pipe Bulletin No. 10 from the Cohoes Rolling Mill Company, Cohoes, N. Y., discusses the properties of Cohoes genuine wrought iron pipe; rust resistance, toughness and strength; bending qualities, etc. This company has branch offices in the principal cities

Porous Concrete Well.—There ar many outstanding features for this typ of well, which is discussed in a folde issued by F. Thorpe, 1932 Illinois Ave East St. Louis, Ill. This folder give a list of references where this type o well has been installed. For partic ulars concerning this type of well writ to Mr. Thorpe, mentioning Municipa News and Water Works.

Pipe Cutter.—This piece of equipmen is made in two sizes for all types o pipe. It is manufactured by Ellis & Ford Mfg. Co., 18 Piquette Ave., De troit, Mich., and particulars are give in a circular, which will be sent upo request by the manufacturer.

Hydrants and Valves.—The Colum bian Iron Works will send descriptiv literature upon request concerning fir hydrants, gate valves, valve boxes, hy drant extension sections and other item of water works equipment. This com pany is located at Chattanooga, Tenn In writing to Mr. W. A. Mattice of thi company for literature, kindly mentio this magazine.

Water Meter Repairs.—Reading Meter Repair Company, Inc., Reading Pa., will be pleased to send informatio and prices concerning repairing or test ing of water meters. This compan carries meter housings, gate valve hous ings, Reading curb boxes and othe hydraulic supplies and equipment When writing to this company for in formation, refer to Munipical News an Water Works. Mr. Emil Neubling wi care for your requests addressed to hin care of the manufacturer.

Centrifugal Pumps.—Write to De Laval Steam Turbine Company, Tren ton, N. J., for book W-67, which give detailed information on geared stea turbine driven pumps, electric moto driven pumps, or internal combustio engine driven pumps. In writing to M H. B. Watson of the company for thi bulletin, kindly mention our publicatio

Flap Gates.—Brown & Brown, Inc Lima, O., will send you upon reques descriptive literature concerning thei flap gates for every purpose. In re questing this information from Mr. C. Brown, we would appreciate it if yo would mention Municipal News an Water Works.

Water Main Cleaning.—This is th subject treated in a booklet issued b the National Water Main Cleaning Co 32 Church St., New York City. Mr. F. Inglee, at the above address, wi send this booklet on request to anyon interested in this problem. Will you us the name of our magazine, if writing

Cast Iron Pipe.—Write to the McWane Cast Iron Pipe Company at Birmingham, Ala., or the Pacific State Cast Iron Pipe Co. at Provo, Utah, for illustrated literature on this product, which is manufactured by a foundry practice of merit proven by centuries of use. If you mention this magazine, Mr. Arthur K. Akers will be pleased to send you a copy.

Deep Well Pumps.—The United Iron Works, Inc. of Springfield, Mo., manufacturers of "Pomona" double stroke deep well power pumps, offer without obligation methods for economically solving pumping problems. Write for data, mentioning this magazine.

Clean Out Augers.—Mueller Co. of Decatur, Ill., with branches in New York, Dallas, San Francisco and Los Angeles, will send you price list and complete details on request regarding time and labor saving devices for water works men. Equipment for cleaning and repairing old service boxes; repair lids to fit old and new type service boxes are described. Address Mr. C. N. Wagenseller, who will be pleased to furnish this information. Kindly mention Municipal News and Water Works.

Chlorine.—The Mathieson-Alkali Works, Inc., 250 Park Ave., New York City, offer the services of their company in furnishing valuable technical information regarding the use of chlorine for health protection; sterilizing water supplies; disinfecting sewage and destroying noxious sewage gases, etc. Write for particulars; address Mr. J. R. Schmertz.

Dual Control Trencher.—Bulletin 20-X gives detailed information regarding the P. & H. Trencher manufactured by the Harnischfeger Corporation, 3902 National Ave., Milwaukee, Wis. One of the important features of this equipment is the fact that the operator can work from either side. This company has branches in all the principal cities. Write to Mr. H. S. Strouse for copy of this bulletin, mentioning this publication.

Mechanical Surface Aeration.—An effective means of producing activated sludge, the economical method of attaining a high degree of nitrification, is described fully in E-5-28, issued by the Simplex Ejector and Aerator Company, 2528 West Madison St., Chicago. Mr. William Buckley will be pleased to send you a copy of this bulletin. Kindly mention this magazine when writing.

Snow Removal Machinery.—A very attractive red, white and blue broadside has just been received from the Cleveland Tractor Company, Cleveland, O., making the problems of heavy snows seem simple when met with this snow removal machinery. Two Cletrac 40's are part of the equipment chosen for the Byrd South Pole Expedition. Mr. H. E. Orr is advertising manager of this company.

Vertical Boom Ditcher.—Barber-Greene & Company, 505 West Park Ave., Aurora, Ill., are featuring their vertical boom ditcher in a booklet, "Ditching, Snapshots and Records," a copy of which will be sent on request addressed to Mr. J. H. Gregory. It would be appreciated if you would mention this publication.

Chlorinator.—Bulletin W-20, issued by the Paradon Manufacturing Company of Arlington, N. J., describes in detail chlorination by the dry feed method. Address Mr. R. V. Donnelly, care of the manufacturer, for booklet on this method of chlorination. Kindly mention Municipal News and Water Works.

Dragline.—Write to Koehring Company at Milwaukee, Wis., or to any of their branches in the principal cities, for Dragline Bulletin DL9. The ease of control and speed in functioning are important features of this heavy duty Koehring equipment. Mr. O. C. Dahlman will furnish bulletin or other information on request. When writing please mention this magazine.

Cast Iron Pipe.—Address Mr. Thos. F. Wolfe, Peoples Gas Building, Chicago, Ill., for authoritative data on any subject pertaining to the use of pipe. Mr. Wolfe is the engineer of the Cast Iron Pipe Research Association, and is ready to render assistance to pipe users at all times. Refer to Municipal News and Water Works if writing for information.

Pipe-Seal.—If interested in jointing compound, write to The Ruberoid Company, New York City, for their folder regarding Ru-Ber-Oid Pipe-Seal. Address Dept. P-43, 95 Madison Ave., New York City, mentioning this magazine.

Automatic Air Lift.—The Sullivan Machinery Company, 130 North Michigan Ave., Chicago, Ill., has a handbook on their automatic air lift, and special automatic control information of particular interest to water works superintendents. A letter to the Sullivan Machinery Company, attention of Mr. S. B. King, will bring you this information. In writing mention Municipal News and Water Works.

Sewage Ejectors.—Yeomans Brothers Company have a complete catalog on Building or Municipal Equipment. This catalog features the Yeomans-Shone Sewage Ejectors and Duplex Bilge Pumps. Write to this company at their Chicago address, 1423 Dayton St., Chicago, for this catalog. Mr. V. S. Weiler of the company will be pleased to furnish you with this catalog if you mention this magazine.

Meter Boxes.—The Ford Meter Box Company of Wabash, Ind., have a special bulletin on the Ford Type S Meter Boxes for "warmer climates." Meters can be set or removed in an instant in this equipment. Mr. John Ford of the company will send this special bulletin upon request, and the use of the name of our magazine when writing would be appreciated.

Centrifugal Pumps.—In order to be of assistance to users in choosing the right pump for their needs, Bulletin 1632-I has been issued by Allis-Chalmers, Milwaukee, Wis. Types for steam turbine drive, motor drive or gasoline engine drive are described to best fit the purposes of installation. Write to Mr. H. G. Hoffman for copy of this bulletin, mentioning Municipal News and Water Works.

Meters.—The Buffalo Meter Company, 2909 Main St., Buffalo, New York, offer a 34-page catalog without obligation giving detailed information concerning Niagara and American meters. A postal card addressed to Mr. C. K. Bassett at the address of the company will bring this catalog to you, free of charge. When writing kindly mention Municipal News and Water Works.

Industrial Cars and Equipment.—Catalog No. 100, issued by the Koppel Industrial Car & Equipment Co., Koppel, Pa., is a reference book and guide for use in the construction of good roads, treating of modern and efficient hauling systems. This catalog is published for the use of highway engineers, state, county and township authorities and road contractors. The booklet contains much helpful data, cross sectional drawings, and specifications and illustrations of equipment. There is a glossary of road terms, published at the recommendation of the Society of Civil Engineers. The catalog contains 50 pages, printed on heavy enamel paper and is firmly bound. A convenient and useful book. In addition to the larger catalog, bulletins No. 43 and No. 51 have been issued by the same company, featuring batch boxes, portable track, koppel cars and other equipment.

Meter Boxes.—Catalog No. 24, issued by the H. W. Clark Company, Mattoon, Ill., will bring you information on how to protect water meters from frost, traffic and tampering. Specifications to accommodate all types. Use the name of our magazine when writing to Mr. Donald Clark of the company for this catalog.

Deep Well Turbines.—The American Well Works of Aurora, Ill., offer without obligation a special engineering bulletin on all types of American Deep Well Turbines. Simply address Mr. H. V. Spiller and booklet will be sent. Kindly mention this magazine.

Engineers' Instruments.—A very complete catalog containing 134 pages is available concerning instruments, equipment and supplies for engineers, draftsmen and architects. It is issued by the A. S. Aloe Company of 1819 Olive St., St. Louis, Mo. Every item is illustrated and price given. The catalog is well indexed and should be very helpful to the engineering profession in renewing or completing their equipment.

New Drive for Sand Pumps

The Climax Engineering Company, of Clinton, Iowa, offers a unique drive for sand pumps where it is not advisable to direct connect the engine to the pump.

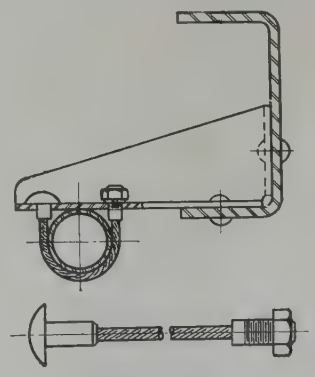
One installation has been made using Climax Model R4U, 6 in. x 7 in., 85 H. P. engine, connected to a 6 in. sand pump with a special drive. This drive is taken from the engine by a Twin Disc Inclosed Clutch and through a Texrope Drive which furnishes the necessary speed reductions between the engine and the pump, permitting the engine to operate at 950 RPM and the pump at 625 RPM. Provision is also made for driving a service or priming pump from the front end of the engine.

In a recent test the capacity of the unit delivered much in excess of 1,000 gal. of clear water per minute, or more than 30 cu. yd. of solids, to a maximum height of 60 ft.

This oufit has proved to be a very popular type for contractors and has an attractive field for installation on barrel type dredges to pump sand and gravel from the bottom of a river or lake to a sorting or screening bin on the shore or at the top of a hill.

Its easy portability and extreme light weight have appealed immensely to the contractor or operator engaged in this business.

The engine may be equipped with an electric starting and lighting outfit and of course cooperates from an ordinary drum by means of a vacuum tank and flexible tubing. The engine may be supplied with or without a radiator.



New Drive for Sand Pumps Announced by Climax Engineering

Simplex Pipe Pushing Jacks

Pipe jacks fill a definite want in the waterworks field. The simpler the unit the better. Templeton, Kenly & Co., Ltd., 1020 So. Central Avenue, Chicago, are marketing a jack made in two sizes. The No. 332 jack handles pipe ¾ in., 1 in., 1¼ in., 1½ in., and 2 in. in diameter.

Weight of jack complete .....198 lb.

Weight of jack without equipment.....146 lb.

Equipment consists of one set of tapered jaws, steel lever bars and extension pipes.

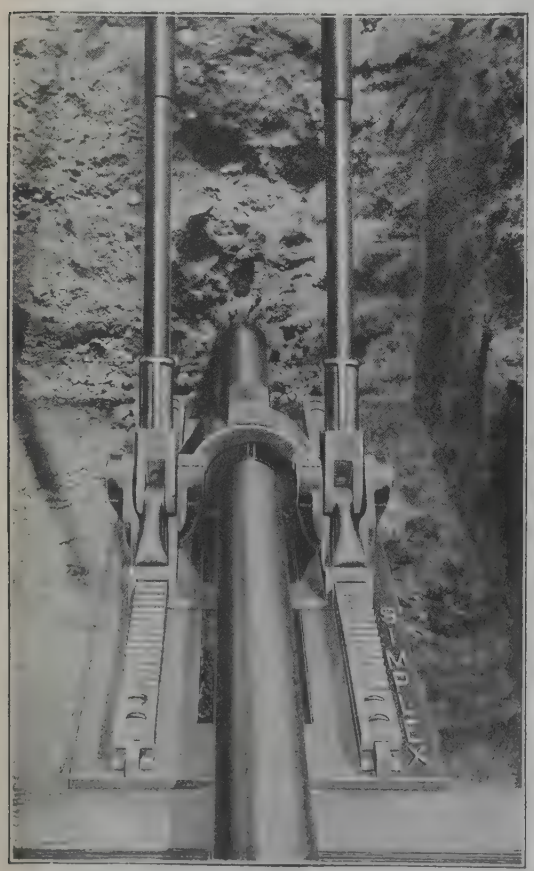
The No. 334 jack handles pipe 2 in., 2½ in., 3 in., and 4 in. in diameter.

Weight of jack complete .....395 lb.

Weight of jack without equipment.....212 lb.

Equipment consists of one set of tapered jaws, steel lever bars and extension pipes.

Both machines have a 25 in. travel and the time required for pushing pipe 25 in. and resetting, it is claimed, averages five to six minutes. The design of the tapered jaws insures the complete surrounding or gripping of the pipe whereby kinks or flattening of the pipe is overcome.

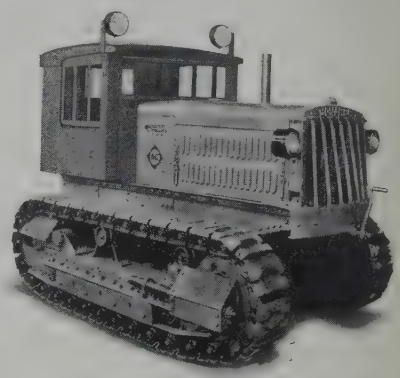


Simplex Jack Pushing Section of 3-in. Pipe

Allis-Chalmers-Monarch Announce Models for Winter Work

The Allis-Chalmers-Monarch "50" and "75" tractors have been equipped for winter work, with fully enclosed weatherproof cabs, constructed to keep the operator warm in the most inclement weather conditions. Full vision glass panes offer maximum visibility. Cabs on both models are roomy, providing comfort for the operator. Special easy detachable and self-cleaning ice and snow grousers, it is claimed, assure positive traction for snow removal and winter logging work. Tracks with grousers cast integral can also be furnished.

These models having great reserve power are especially adapted to snow removal work. Various makes of heavy "V" type and rotary plows are easily attached. This is a desirable combination in removing the snow blockade quickly and surely.



Allis-Chalmers-Monarch Equipped for Winter Work

Snow blockades cost the United States and Canada hundreds of millions of dollars annually. They tie up commerce, increase manufacturing and transportation costs, damage road and highway surfaces, increase fire hazards, delay mail service, and cause endless inconveniences. Every year the terrific toll exacted by snow blockades is felt by hundreds of thousands of people in every walk of life, by every city, large and small. Everywhere, taxpayers and public officials are awakening to the realization that their roads must be kept clear—that their concrete highways which cost them approximately $30,000 per mile of their own money must receive the best winter protection that can be procured. Protection against the wastes of snow blockade means only one thing—efficient, dependable snow removal.

Complete details of the above models can be obtained by writing for the booklet, "The Removal of Snow," to Monarch Tractors Corporation, Springfield, Ill.

The New "American" Sump Pumps

The American Well Works has just announced a new and improved line of sump pumps having many advantages over the old type. This new line, besides being self-controlled, is claimed to be highly efficient and sturdily built to meet the unusual in service and to stand up under abuse.

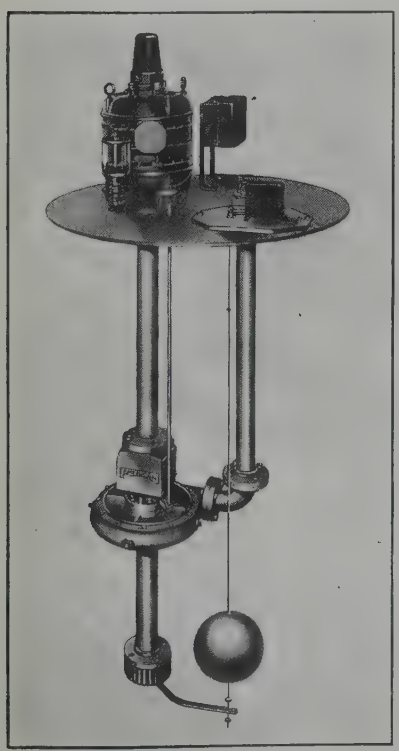
The "American" type M. M. D. sump pump differs from other motor-driven pumps in that it employs a hollow shaft motor in place of the old solid shaft type. This construction makes possible a simple compact pump. By this construction, flexible couplings and thrust bearings are eliminated. The pump shaft extends up through the motor shaft, hence both motor and pump use the same thrust bearing which is mounted in the upper end of the motor, making adjustments very easily.

The elimination of high motor supports is made possible as the pump supporting pipe is bolted through to a cast iron plate that in turn bolts to the motor. Regardless of distortion in the pit cover, the alignment of the pump and motor is not affected.

The pump shaft bearings consist of removable bushings. The pit plate is made of plate steel and is furnished either round or square. Pump may be had for all standard settings up to 17 ft. in either single or duplex units.

All units are furnished complete with float control switch, oiling device and motor.

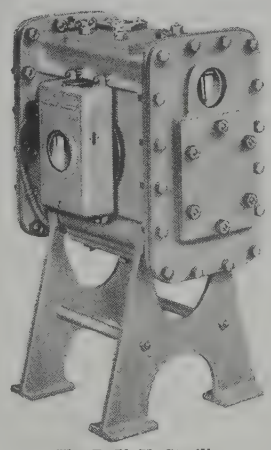
The American Well Works has published complete specifications and catalogs covering this new type pump, which will be sent to anyone interested without obligation.



Type M.M.D. Sump Pump

Ultra-Violet Ray Water Sterilizer

A small piece of equipment for sterilizing water by the employment of ultra-violet rays is announced by James B. Clow and Sons, P. O. Box N. N., Chicago, Ill. Sterilization under the R.-U.-V. patents applies to water supply of swimming pools, drinking water, bottled beverages, and steamship drinking water. Operating cost is very low; the system is simple. Sterilization is positive, because infallibility of attendant is not essential.



The R.-U.-V. Sterilizer

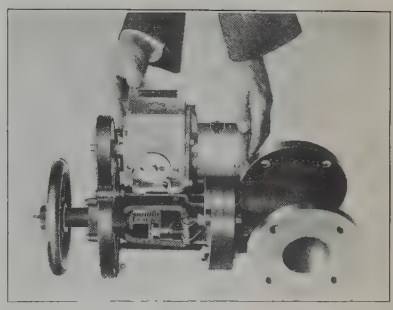
During the convention of the American Public Health Association in Chicago in October a private demonstration of R.-U.-V. was arranged by Dr. Kegel, health commissioner of Chicago, which aroused considerable interest among the public health officials present.

New Motor Driven Mechanism for Operating Valves

A new motor driven valve operating unit has just been announced by the Cutler-Hammer Mfg. Co., Milwaukee, Wis., which makes possible automatic operation of all valves up to 6 in.

Although so small that it can be held in one hand, this unique operating unit has a rating of 15 lb. ft. It can be operated automatically by means of float switches, temperature controlling devices, pressure regulators, etc., or by conveniently located push buttons.

Although only recently placed on the market this valve operating unit is similar in principle to the standard C-H "Dean" operating unit which has a successful record of 12 years.



New Motor Driven Valve Operating Mechanism

While designed primarily for valve operating service in industries where regulation of pressures and temperatures of gases and fluids is necessary, it is likewise adaptable to many miscellaneous applications.

Literature describing this new unit (called C-H type Ao Valve Operating Unit) will be sent free, upon request to the Cutler-Hammer Mfg. Co., 1298 St. Paul Ave., Milwaukee, Wis.

Burroughs Electric Calculator

An electrically operated calculator is being introduced by Burroughs Adding Machine Company.

The electric operation, it is claimed, reduces the actual physical effort on the part of the operator to a short depression of the keys. The light key touch, which is uniform for all keys, actuates the motor and the motor instantly completes the operation. This new key touch with the motor doing the work, results, the company states, in greater operating efficiency and greater production per operator.

Another advantage claimed for the new Burroughs machine is positive key action. Errors due to incomplete strokes of the keys are impossible, the company states, as the operator cannot short-stroke or otherwise misoperate a key.

The new calculator is similar in size and appearance to other Burroughs machines of this type. The small motor

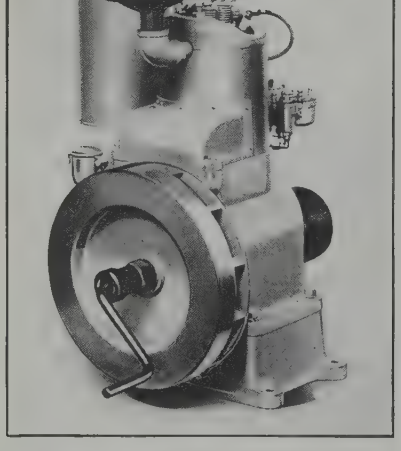
Burroughs New Electric Calculator

is entirely enclosed within the case and operates on alternating or direct current. It runs only when a key is depressed.

The new calculator, in ten-column totaling capacity size, is being shown in Burroughs offices throughout the country and deliveries are being made. Production of the new machine is being increased steadily, the company states, so that within a short time immediate deliveries can be made.

New Vertical Air-Cooled Engine Announced

The Lauson, vertical air-cooled engine, fills the increasing demand for a motor built on automotive lines, but not too heavy in weight, and with working parts substantial enough to give continuous service. Neat, compact, self-contained construction makes it readily



Showing New Vertical Air-Cooled Engine

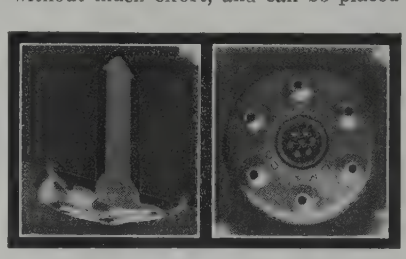
applicable to portable units. It also meets the demand of stationary power users for a motor of the higher class design that can be installed on water or light units in a power house or wherever smooth, quiet operation coupled with cleanliness is appreciated.

Specifications

Number of cylinders	1
Bore	2¾ in.
Stroke	3¼ in.
Cycle	4
Speed	900 to 1,400 r.p.m.
Horsepower	1½ at 1,200 r.p.m.
Ignition	Wico type B magneto
Fuel	Gasoline
Carburetor	Tillotson
Flywheel diameter	12 in.
Flywheel face	2¾ in.
Crankshaft bearings	1⅜ in.
Crank pin	1¼ in.
Governor	vertical flywheel type, gear driven, enclosed in dustproof housing, speed adjustable
Height over all	24½ in.
Width over all	21⅜ in.
Pulley	4⅝ in. diam., 3 in. face, fibre
Net weight	170 lb.
Domestic shipping weight	200 lb.
Export shipping weight	260 lb.
Boxed for export	10 in. x 19 in. x 30 in.

Non-Slip Street Buttons

Advantages of the small metal unit for marking street car loading zones and traffic lanes have been generally accepted. They seem to have a long life, can be installed with speed and without much effort, and can be placed



Cross-Section and Top View of Non-Slip Street Button

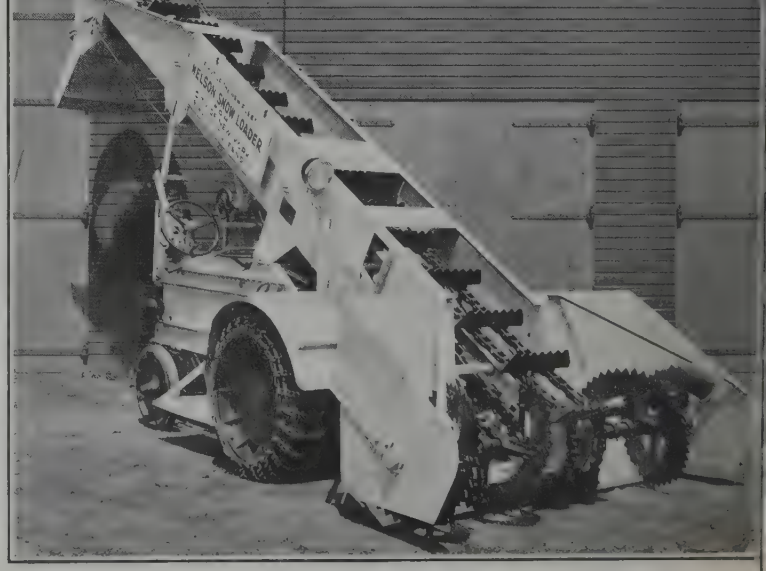
in practically every type of pavement without resurfacing or danger of damage to the surrounding pavement. The one disadvantage of the types now in use is that their smooth, shiny tops, sometimes cause pedestrians to slip on them, especially in rainy weather, or during snow or sleet storms.

To get around this, a new type of button with a perforated top has been developed. These buttons are constructed from a piece of heavy "stainless" iron plate into the center of which is upset a substantial anchor bolt. The tops of these buttons are crowned with a number of raised vacuum cups placed around the outside rim bringing it back to a horizontal plane. The edges of the button are turned down and enter into the pavement, to give a wide base and prevent it from working itself d into soft pavements. This featur also intended to prevent the bu from being torn out by snow plow scrapers.

Further information may be obta from the manufacturers, The Chi Manufacturing & Distributing C pany, 4010 S. Wells St., Chicago, Il

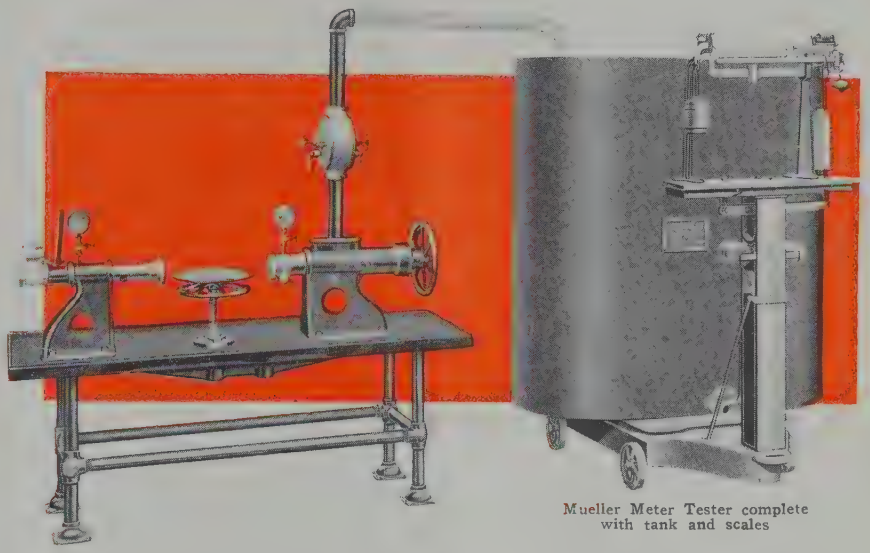
New Snow Loader

The latest model of the snow lo of the N. P. Nelson Iron Works, Passaic, N. J., is illustrated herev The machine takes its power from hp. Hercules engine. This drives conveyor and feeder and is conne through the clutch and transmissio the worm gear differential. H chain and sprocket drives extend f the differential axles to the lock sh and tractor wheels. The lock sh which are an essential part of the son transmission, carry a manu controlled clutch which, when enga makes both traction wheels move the same speed. If slippery pavem cause one wheel to spin, thereby stroying the tractive power, the of a handle locks both transmis wheels together and compels both work. All wheels are on Timken r bearings. The loader has eight spe three forward and one reverse, in high-speed group, and three revers digging speeds and one forward or out speed on the low speed group. speed range is from 8 miles per in high, down to 30 ft. per minute digging. The loader has three i pendent sets of brakes.



New Nelson Type R-5 Special Snow Loader Owned by City of New York

Statistics show that meters under-register oftener than they over-register—



Mueller Meter Tester complete with tank and scales

MUELLER Meter Testers prevent waterworks losses

Here is an important saving made possible—through which honestly earned revenues are collected that never could be through any other method.

A Mueller Meter Tester included in your appropriation for 1929 will soon pay for itself out of the savings it makes. All meters should be tested before installation and periodically thereafter.

Simple operation is a prominent characteristic of the Mueller Meter Tester and the workmanship and quality of material in its construction are of the high type always associated with the name of Mueller. It will give a lifetime of service.

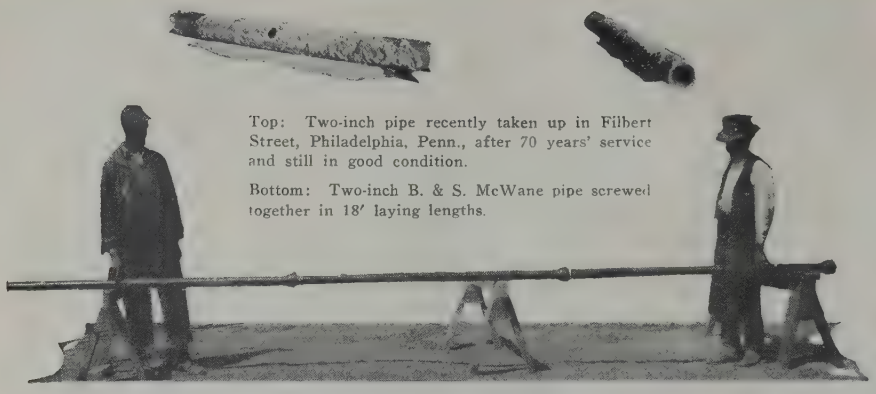
A catalog that gives complete information on the Mueller Meter Tester will be mailed on request.

MUELLER CO. *(Established 1857)* Decatur, Illinois

Branches: New York, Dallas, San Francisco, Los Angeles

Canadian Factory: MUELLER, Limited, Sarnia

MUELLER



Top: Two-inch pipe recently taken up in Filbert Street, Philadelphia, Penn., after 70 years' service and still in good condition.

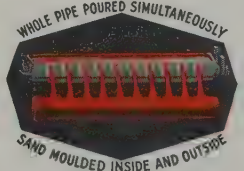
Bottom: Two-inch B. & S. McWane pipe screwed together in 18′ laying lengths.

Why You Should Say "McWane" When You Buy Small Pipe

McWane is the largest manufacturer of small diameter cast iron pipe in the world . . . the only maker of 1¼" pipe. McWane leadership in this field is not an accident. Years of research and specialization are back of it.

Small diameter cast iron pipe has been made for a century . . . witness the photographs above of Philadelphia pipe 70 years old and as good as new. But McWane pioneered the manufacture of this product on a commercial scale in the last decade.

It is consistent to use cast iron for service lines the same as for your mains . . . then your entire pipe system is permanent construction. The *cost per year* of cast iron service lines is far less than any substitute.



McWane small diameter pipe is furnished with or without Precalked joints . . . lengths of 6′, 12′ or 18′ . . . is easily, simply and swiftly laid . . . can be tapped direct, under pressure, without fittings.

WRITE FOR ILLUSTRATED LITERATURE

McWANE CAST IRON PIPE CO.
BIRMINGHAM, ALA.

PACIFIC STATES CAST IRON PIPE CO.
PROVO, UTAH

SALES OFFICES IN PRINCIPAL CITIES

McWANE
CAST IRON PIPE